Proceedings of the 4th Asian Regional Conference and 10th International Seminar on Participatory Irrigation Management

2 – 5 May 2007
Tehran, Iran

Organized by:

◈Iranian National Committee on Irrigation and Drainage (IRNCID)
◈International Commission on Irrigation and Drainage (ICID)
◈International Network on Participatory Irrigation Management (INPIM)

Organized by:

Proceedings of Papers

The 4th Asian Regional Conference & 10th International Seminar on Participatory Irrigation Management

Co- organizers:

Note:
The Seminar organizers accepts no responsibility for the Statements made, opinions expressed and maps included in these papers which presented in the Seminar.

2007

ISBN:964-6668-65-8

The 4th Asian Regional Conference and
10th International Seminar on Participatory Irrigation Management
Tehran, May 2-5, 2007

Preface:

Accomplishing its mission, ICID sponsors different Regional and International Conferences which include workshops as one of its priorities. The 1st Asian Regional Conference (ARC) was held on the theme, “Agriculture, Water and Environment”, in Seoul, Korea during September 2001. In March 2004, with the cooperation of Australian National Committee on Irrigation and Drainage, the 2nd ARC was held on the theme, “Total Catchment Management” in Moama, Australia. The 3rd ARC focused on the theme, “Transforming Irrigated Agriculture into an Efficient Engine of Growth” and was held in Malaysia on 13-15 September 2006 with the support of Malaysian National Committee on Irrigation and Drainage.

On the other hand, the International Network on Participatory Irrigation Management (INPIM) usually holds International Seminar on Participatory Irrigation Management in the various countries which Ninth International Seminar on PIM and the main theme of “Institutional and Technological Interventions for Better Irrigation Management in the New Millennium”, held in Lahore, Pakistan from 4-8 December 2006.

With coordination to ICID, IRNCID, INPIM, the 4th Asian Regional Conference and the 10th International Seminar on Participatory Irrigation Management (PIM) will be held in Tehran, Iran from May 2-5, 2007, with the following sub-topics: (1) A Review on Participatory Measures in Irrigation, (2) Required Grounds and Facilities for PIM Formation, (3) Support System for PIM Sustainability.

Having arbitrated 200 abstracts from various countries, the Conference Scientific Committee accepted 140 ones. Finally, 115 full-papers were submitted to the International Seminar Secretariat in due time of which 80 ones were accepted to be presented orally, 22 in poster, but the rest were rejected.

Expecting over 500 experts, professors, and interested participants in PIM, The Seminar Secretariat cordially welcomes all the honorable delegates and believes that the scientific Tehran Seminar will be an unforgettable opportunity to exchange view-points, transfer experience and technology, as well as, accelerate launching Water Users Associations (WUAs) in the Regional Countries with sustainable improvement and growth. Good Luck and Thanks.

Dr. R. Zargar
Deputy Minister for Water Affairs, and
Seminar Organizing Committee, Chairman

Introduction

Various environmental, technical & socio-economical challenges/ Issues due to the cultural, local, regional, and ecological fluctuating conditions are reported in different performed irrigation and drainage projects. In such approach, one of the recent focal issues to be considered internationally is Irrigation Management Transfer IMT to the farmers.

The researchers believe that IMT causes the government financial burden to decrease. Besides, reforming the performance know-how & the Networks Management System, decreasing the organizational bureaucracy, and applying software facilities shall certainly increase the farmers' production, productivity and profitability.

Farmers are the main factor in Water Use Management and agricultural products. Optimum productivity process of Irrigation & Drainage Networks depends on considering the effective role of the farmers.

Fulfilling sustainable PIM efficiently requires innovative proper approaches, profound comprehensive studies, as well as, practical and scientific view-points.

Hence, holding Tehran Conference/ Seminar is a suitable opportunity to exchange expertise and technologies obtained from different countries, to study the required socio-cultural multi-disciplinary areas of performance norms & criteria in order to result in sustainable PIM process.

This scientific event on PIM shall be held by IRNCID, ICID, and INPIM in Tehran, during 2-5 May 2007 with the following Topics.

Theme: Participatory Irrigation Management (PIM)

Sub-themes:

1. A Review on Participatory Measures in Irrigation

1.1 Implemented and proposed processes (frameworks, methods and indices).
1.2 Success stories on implemented projects.

2. Required Grounds and Facilities for PIM Formation

2.1 Organizational reforms.
2.2 Cultural, social and political grounds.
2.3 Legal frameworks and norms.

3. Support System for PIM Sustainability

3.1 Policies and strategies.
3.2 Capacity building, training and extension.
3.3 Monitoring and evaluation.

Conference/Seminar Organizing Committee:

Dr. Rasoul Zargar Deputy Minister For Water Affairs, Ministry of Energy of the I.R. of Iran Chairman, IRNCID	
Mr. Seyyd Assadollah Assadollahi Secretary General , IRNCID	**Mr. Mohammad Kiafar** Managing Director, Mahab Ghodss Consulting Engineering Co.
Dr. Saeed Nairizi ICID Hon., Vice President Managing Director ,Toos-AB Consulting Engineering Co.	**Dr. Seyyed Jafar Hejazi** Managing Director, Khuzestan Water & Power Authority
Dr. Karim Shiati Vice President, ICID Chairman, ICID Asian Regional Working Group and Yekom Consulting Engineering Co.	**Mr. Rahim Sajadi** Senior Expert, Ministry of Jahad-e-Agriculture
Dr. Hassan Rahimi Tehran University Professor Irrigation and Drainage Department	**Mr. Mehrzad Ehsani** Secretary, IRNCID/Seminar
Mr. Oskouei Manager, Public Relations, Iran Water Resources Management Co.	**Mr. Ali Ebrahimzadeh** Conference Executive Coordinator
Mr. Ali Ghasemi Irrigation and Drainage Expert	

Scientific Committee

Dr. Karim Shiati Vice President, ICID Chairman, ICID Asian Working Group Head of Scientific Committee Email: k_shiati@yahoo.com ***Iran***	**Dr. Intizar Hussain** Executive Director, INPIM Email: ihussain@inpim.org ***Pakistan***
Dr. Seyyd Ahmad Heydarian Chairman, IRNCID Working Group on PIM Email: saheyd@yahoo.com ***Iran***	**Dr. Hafied Gany** Head of INPIM Chapter in Indonesia Vice Chairman, INACID Email: gany@hafied.org ***Indonesia***
Dr. Plusquellec Herve Senior Expert, The World Bank Email: plusquel@earthlink.net ***French***	**Dr. Safwat Abdel-Dayem** Vice President Hon., ICID Email: safwat_eid@hotmail.com ***Egypt***
Mr. Abbas Gholi Jahani Expert of Bahan Sad Co. Email: jahani1325@yahoo.com ***Iran***	**Mr. Mehrzad Ehsani** Secretary, IRNCID/Seminar Email: info@irncid.org ***Iran***

The 4th Asian Regional Conference and 10th International Seminar on Participatory Irrigation Management

Key Speakers

Theme 1- A Review on Participatory Measures in Irrigation

Theme 2- Required Grounds and Facilities for PIM Formation

Theme 3- Support System for PIM Sustainability

The 4th Asian Regional Conference &
10th International Seminar on
Participatory Irrigation Management

Tehran-Iran   2-5 May, 2007

Key Speakers

PROBLEMS AND PERSPECTIVES OF PARTICIPATORY IRRIGATION MANAGEMENT UNDER THE SMALL LAND-HOLDING CONDITION: WITH A SPECIAL REFERENCE TO INDONESIAN PRACTICE©

A. Hafied A. Gany[1]

ABSTRACT

Indonesia achieved remarkable progress in water resources development within thirty years till 1997 through government led development projects. However, the institutional development to sustain this progress got insufficient attention. From the lessons learned before the multidimensional crisis, it has been recognized that the severe crisis had been due to the chronic neglect of the farmers' roles in almost the entire process of development, rehabilitation, and routine operation and maintenance of irrigation infrastructures.

In an attempt to resolve the dilemmatic situation to maintain sustainable rice production on the one hand, while keeping pace the productivity level with the increasing population growth on the other, an emphasis has been given to irrigation development and management based on participatory approach. The program had been set up to reduce central government's burden on Operation and Maintenance (O&M) costs aiming for sustainable irrigation O&M by virtue of "Participatory Irrigation Management – PIM" approach.

Under the said program, a number of policy adjustments on water resources had been enacted. Further to this, PIM attempts have also been carried out including: turning over to the Water User Association – WUA, of small irrigation schemes; encouragement of irrigation service fee (ISF); Irrigation Management Transfer (IMT); Participatory design and construction program; "field laboratories" for visual process of "learning by doing", and other such government initiatives. However, it turned up that the attempts has been going very slowly and yet, still tended to be least sustainable. This has been partially suspected by the fact that the economy of the farmers and farming conditions under the fragmented land ownership, which in fact, are already small, has been marginalizing the

© This paper has been prepared by Mr. Hafied Gany, Ph.D., P.Eng., for the 4th Asian Regional Conference of ICID and the 10th International Seminar on Participatory Irrigation Management (PIM), Tehran - Iran, May 2 – 5 May 2006. -- Mr. A. Hafied A. Gany is currently the Senior Adviser on Water Resources, and Irrigation, Ministry of Public Works, Republic of Indonesia; Vice President of the Indonesian National Committee of ICID (INACID) for International Affairs; Member of Board of Director of "The International Networks on Participatory Irrigation Management (INPIM)"; and President of the Indonesian Chapter of INPIM – INPIM-INA. gany@hafied.org; gany@scientist.com; hafiedgany@gmail.com

1- gany@hafied.org; http://www.hafied.org

already marginal incomes. As a result, the small income farmers are hardly available to participate with the PIM's endeavors.

To facilitate resolving the problems, the newly enacted Water Law No. 7/2004, together with the Government Regulation No. 20/2006 about "Irrigation", prescribe that the O&M responsibility for primary and secondary canals belongs to the Central Government, Provincial as well as Local Autonomous Government with certain role sharing criteria settled down by the Government Regulation on Irrigation Management. For reducing the burden of the farmers, they assigned responsibility to operate and maintain the tertiary canals through their water users associations (WUA).

This paper intends to discuss a series of practices, problems, and perspectives on participatory irrigation management under the small land holding condition, the implication of the new policies on technical and traditional irrigation schemes, institutional and legal aspects of O&M, as well as the role of WUA's. These include technical, institutional, and financial, as well as regulatory instruments, and other such measures toward sustainable PIM implementation.

Key Words: Irrigation Management; Small Land Holding; PIM Approach; and Indonesia

I. INTRODUCTION

Indonesia, with the total population of 72 million at the time of Indonesia's independence in 1945, has now stepped into the fourth most populous country in the world, with an estimated population of about 220 million inhabitants. The population growth rate has been reduced significantly from 2.9 percent fifty years ago to about 1.9 percent now. It is projected that the population growth will be about 280 million people by the end of 2025. At that period, it is estimated that 52% of the nation's people are predicted to live in urban areas.

The excessively rapid expansion of the country's population concurrently with high rate of urbanization has brought about a special problem on the provision of adequate rice (the staple food) to feed its people. About 70% of the populations are traditional rice farmers living in rural areas. This matter has even created more crucial problems to the provision of adequate food supply for the country's population. (See **Figure 1**. and **Figure 2**. for the general projection of population growth, rice demands and potential.)

One of the most apparent constraints on rice production is that the land ownership per farming household is somewhat too small, that the farmer cannot fully dependent upon the farming income for supporting their life with their families. For this reason, the farmers are forced to earn additional income in the urban areas. This alone inhibits special problem on the continuity of their agricultural lands being left occasionally and hence unable to maintain consistent care of their plants. In addition, it is apparent that the size of land holding is increasingly decreasing due to the impact of land fragmentation, and the continuing land conversion to non agricultural utilization, as well as transfer of land ownerships.

1.1. PRESENT STATUS OF LAND USES FOR FOOD PRODUCTION

In order to feed the currently 220 million inhabitants, it is estimated that at least 50 million tons of paddy rice per year is required. Paddy in Indonesia is produced in irrigated lands, wetlands, as well as in the rain-fed upland areas with a grand total of about 12.34 million ha, and with the average cropping intensity at about 1.37.

The most immediate problem has been associated with the capacity to sustain the food production, in the mean time, with population growth rate of, say 1.5% per annum, rice production should increase by about 900,000 tons per year to catch up the increasing demands. With the same assumption, this food demand is roughly equivalent to about 140,000 ha of additional land areas annually. This figure has yet counted for the annual land conversion from agricultural lands to other land use categories -- which is estimated at the range of 25,000 and 40,000 ha annually.

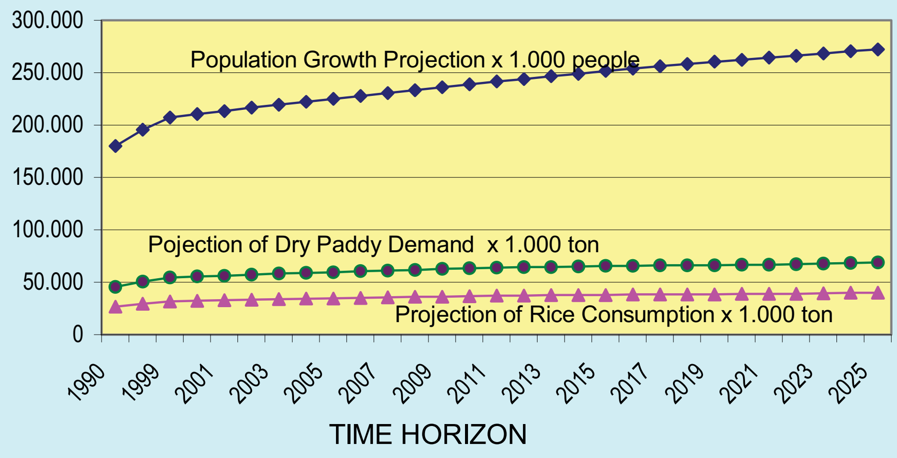
II. IRRIGATION DEVELOPMENT AND MANAGEMENT

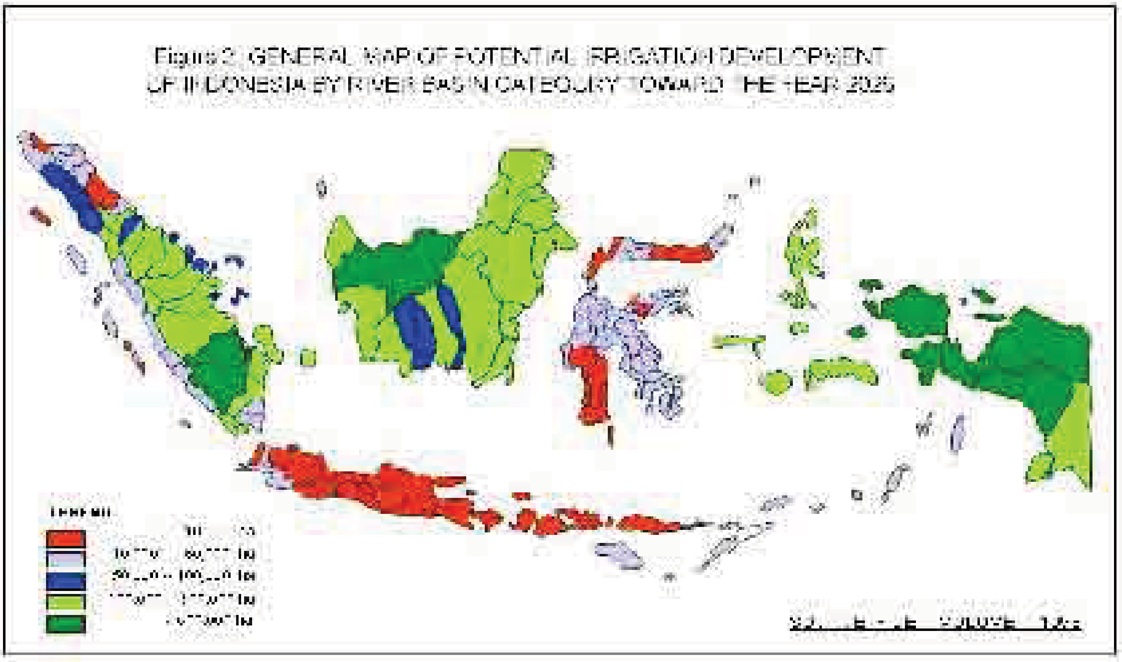
2.1. IRRIGATION SYSTEM AND MANAGEMENT

The newly enacted Government Regulation No. 20/2006 defines irrigation as the means of provision, regulation and releasing of irrigation water for appropriate support to agricultural implementation, having some categories as surface irrigation, swamp irrigation, sub surface irrigation, pumping irrigation and fish ponds.

Basically, the government responsible for operation and management of the main system (primary and secondary networks), while the farmers, through the water users' association (WUA), responsible for operation and management of tertiary irrigation schemes. In this regards, the government (Central Government) is responsible for conducting irrigation O&M of independent irrigation scheme having a total commanding area of more than 3,000 ha. The Provincial Government responsible for managing irrigation scheme having independent commanding area between 1,000 and 3,000 ha. While the local government (Regency or Municipality), responsible for managing irrigation schemes having less than 1,000 ha per individual scheme, and the Village Government responsible for development and management, as well as rehabilitation, reconstruction and upgrading of village irrigation scheme.

Figure 1. PROJECTION OF POPULATION GROWTH, RICE CONSUMPTION, AND PADDY PRODUCTION TOWARD THE YEAR 2025





Meanwhile, the water user's community is further responsible for: (1) Implementation of tertiary irrigation development and management; (2) Maintaining an effective and efficient operation and management of tertiary irrigation schemes; (3) Approval for development, utilization, as well as reconstruction, rehabilitation and upgrading of tertiary irrigation scheme on the basis of participatory approach. For this, the participatory irrigation development and management approach has to involve the farming community from the initial decision making, throughout the entire process of development, upgrading, operation, maintenance, as well as rehabilitation of irrigation schemes.

In principle, irrigation water management covers the management of irrigation networks and irrigation water has to be implemented based on participatory, integrated, transparent, accountable and sustainable principle. Water management activities in the main system, which is referred to as **"water distribution and drainage management"**, are managed by the government while water management at the tertiary and quaternary canals as well as direct application of water to the crops, which is referred to as **"on-farm water management"** are managed by the farmers.

2.2. PRESENT STATUS OF IRRIGATION DEVELOPMENT

During the past few decades, the government policy in irrigation development has been implemented in line with the National Development Policy. At present, the status of irrigated lands for paddy production in Indonesia (based on 2003 data) has a grand total of 10,176,069 ha including the irrigated paddies, upland and rain fed (See **Table 1.**) for further details. From this table, it is apparent that the total production of irrigated paddies at about 48,794,000 tons of dry un-husked rice, contributes almost 95% of the total production of about 51.48 million tons. Hence the upland and rain fed paddy contributes only 2.682 tons or 5% of the total paddy production of Indonesia.

Table 1. Irrigated land and paddy production in Indonesia, (2002)

Island	Area (ha)	Cropping Area (ha)	Total Yield (ton) *)	Average Yield (ton/ha)
Sumatra	2,401,697	2,674,589	10,826,103	4.048
Java	3,396,299	5,263,179	27,615,900	5.247
Bali & Nusa Tenggara	370,192	527,965	2,435,966	4.614
Kalimantan	1,366,520	781,851	2,519,011	3.222
Sulawesi	904,597	1,201,876	5,327,109	4.432
Maluku & Irian (Papua)	-	22,629	74,147	3.100
Indonesia	**8,439,305**	**10,472,089**	**48,794,236**	**4.659**
Sugarcane	496,000			
Total irrigated lands	8,396,205			
Upland Paddies	1,239,864	1,058,583	2,682,343	2,534
Total Paddy **)	**10,176,069**	**11,530,672**	**51,476,579**	**4,464**

Source: Statistical Year Book of Indonesia 2003, BPS Statistics Indonesia

*) Dry un-husked rice;
**) Total irrigation areas for paddy, including upland and rain fed paddies.

2.3. INTER-AGENCY COORDINATION FOR IRRIGATION MANAGEMENT

To ensure the efficient and effective use of irrigation for supporting agricultural implementation as well as for serving other functions and purposes of irrigation are established. There are several categories of irrigation commission namely; Provincial Irrigation Commission; *Kabupaten* (District) Irrigation Commission; and Inter-provincial Irrigation Commissions. The composition of these irrigation commissions are as follows:

Provincial Irrigation Commission: The commission establishes by the Governor composed of the representatives of irrigation commissions of the regencies and/or municipalities within the province concern, representative of water users' associations, representative of the provincial government and the representative of water users having proportional representation.

District Irrigation Commission: The commission establishes by the Regent (The *Bupati*, or Mayor) composed of representatives of the local government and other government agencies, representative of water users' associations, representative of water users having proportional representation.

Inter-Provincial Irrigation Commission: The commission establishes by the concerned Governors composed of the representatives of irrigation commissions of the regencies and/or municipalities within the province concern, vice chairpersons of provincial irrigation commissions, representative of water users' associations, representative of the provincial government and the representative of water users having proportional representation.

Coordination of irrigation activities are usually conducted by irrigation commissions within the provincial jurisdiction, district or municipalities as well as for inter-provincial irrigation commission. However, for a large irrigation system, the service area is usually located under more than one provincial or district government administrations. In such the case irrigation development and management are implemented jointly with the provincial or District Irrigation Commissions under the coordination of the inter-provincial or provincial irrigation commission concerned.

III. EXPERIENCES ON PARTICIPATORY IRRIGATION MANAGEMENT

Government assistance in irrigation construction has usually been followed by a continuing bureaucratic role in O&M, with farmers' responsibilities limited to their own fields and tertiary areas of a size usually in the range of 50 to 150 hectares. Management of dams, primary and secondary canals, tertiary gates and the first fifty meters of tertiary canals are the responsibility of the government. Concern about how irrigation systems could be better operated and maintained the Indonesia's 1987 Irrigation Operation and Maintenance Policy Statement, advocated the following policies: (1) Gradually turn over irrigation systems smaller than 500 hectares to WUA; and (2) Institute irrigation service fees (ISF) for systems larger than 500 hectares; (3) "Starter" On-Farm Water Management Development.

3.1. TURNOVER OF SMALL SCALE IRRIGATION SYSTEMS

The main objective of the transfer of small irrigation systems from the government to Water Users' Associations (WUAs) is to enable better use of farmers' knowledge, skills and other resources to manage the local irrigation systems, while the intermediate objective is to turn over all irrigation systems smaller than 500 ha to WUA, and gradually turn over the larger schemes.

Following government policy, the Ministry of Public Works has issued an ordinance as a guideline for turning over of small scale irrigation system and management authority to the WUA. The scope of activities of the turnover of small scale irrigation including: (a) the turnover of assets of small scale irrigation systems; and (b) the turnover of jurisdiction, duties and responsibilities of O&M.

The World Bank, the Asian Development Bank, and the Ford Foundation were supporting funding of the turnover activities at that stage. Under ISSP-I, the turnover activities began in 1987 in West Java and West Sumatra. In 1988/1989 fiscal year project activities expanded to four provinces, West Java, Central Java and Yogyakarta, and West Sumatra; and in 1989/1990 the turnover program was expanded to seven provinces, West Java, Central Java, East Java, West Nusa Tenggara, Yogyakarta, South Sulawesi and West Sumatra. Up to the beginning of April 2000, the total areas of 385,000 ha have been turned over to WUAs. The program has been slowing down few years after due to the urgent priority of the government to recover the economic crises.

3.2. INVOLVEMENT OF THE FARMER (PARTICIPATORY DESIGN AND CONSTRUCTION)

Within the design and construction phase, requests are ranked according to farmers' priorities. These requests are used in the preparation of the technical design for construction and improvement works. In the follow-up stages, involvement of the farmers in the construction and implementation provides an opportunity to strengthen farmer's organization through participation in collecting information, planning improvements and contributing to construction.

Water user associations are developed and registered with the *Bupati*, Head of District Government, and then further training is given to the WUAs in O&M activities. After the necessary training has been implemented, the irrigation systems assets and management responsibility are officially transferred to WUAs. The Provincial Public Works will continue to play a role in supporting the activities in line with the technical assistance which are beyond farmers' capacity to perform by them.

3.3. PILOT SCHEMES (FIELD LABORATORY) FOR MAJOR IRRIGATION SYSTEMS

Following the success of turn over of some 385,000 ha of small scale irrigation under the small scheme transfer policy, a number of pilot projects for transferring the larger schemes at the average of 1,000 ha were undergone (for learning by doing process) at 10 schemes in the Eastern Region with the total area of about 15,000 ha, and four schemes in Java with a total area of 62,425 ha, or 77,425 ha altogether. Similar to the above attempts toward Participatory Irrigation Management, the pilot schemes also suffered from a number of technical and non-technical constrain parallel with the severe economic crises. Despite that the projects have different level of success; the activities have been slowing down since then.

3.4. IRRIGATION SERVICE FEE (ISF)

Irrigation Service Fee (ISF) is a contribution in the form of money by farmers as the beneficiaries of irrigation water, in order to finance the O&M of irrigation networks. In principle, ISF is not a tax, rather, it is a way to encourage participation of the beneficiary to pay for the sustainable O&M of the schemes by themselves; thus, the farmer is only pay this contribution in lieu of irrigation service they obtained.

The introduction of ISF is one of the government policy on irrigation O&M in order to minimize the government subsidy in providing O&M budget, and ultimately this ISF become a major source in providing O&M budget for irrigation networks. For actual implementation of ISF within the entire irrigation areas in Indonesia, four principles had been suggested: (1) Maintaining a proper balance of ISF collection; (2) Application of direct use of the collected fee; (3) Application of simplified tariff; and (4) Fostering sustainable implementation.

3.5. LESSONS FROM EXPERIENCES

In an attempt to accelerate the implementation of participatory irrigation management (PIM), a number of efforts have been implemented without considering the problems and constrains of each specific locations. The standardized approach was then implemented nationwide – despite the diversity of social, economy, geography, as well as climate and cultural background. As a result, a number of traditional and local practices have been set aside and apply alien technologies instead. During which, the country's economy has concurrently been suffered from multi-dimensional crisis, and hence the project implementations have also been significantly affected. This had been due to a number of inter-related problems and constrains both internally within the farming circumstances as well as external matters which are beyond the institutional capacity to tackle with. Parallel with the multi-dimensional crisis and the need to implement the policy on "Local Autonomy" within the country, the pilot projects have also been slowing down, and currently suffer from inadequate attention.

In order to quickly recover from the impacts of multi-dimensional crisis the government has been taken some policy reforms, including the review of irrigation policy and follow up implementation. This has been stipulated in the newly established Water Law No. 7/2004 about Water Resources; and subsequently followed by the Government Regulation No. 20/2006 about Irrigation. The regulatory instruments have been established with special consideration on the past experiences, and then the subsequent implementation will be based on the newly established legal and regulatory instruments.

IV. CONSTRAINTS OF SMALL LAND HOLDING FOR PIM

4.1. IRRIGATION AND WATER RESOURCES POLICY REFORM

In 1987 the government of Indonesia released a national policy on O&M of irrigation. The purpose of this policy has been to ensure adequate funding for O&M and improve irrigation management. Government committed to increase budget allocation for O&M, strengthen land and property taxes, as well as mobilizing more resources from beneficiaries. After a long process, the Government of Indonesia has recently been managed to enact the new Water Resources Law (UUSDA No.7/2004). For subsequent implementation, a new Government Regulation – PP No. 20/2006 regarding irrigation has subsequently been established. The Law prescribes delegation of responsibility to local autonomous government to conduct irrigation operation and management based on categorization of irrigation areas in conjunction with the coverage area of the provincial and local government administrative boundary.

4.2. CONSTRAINTS OF SMALL LAND HOLDING

Farmer's Household: About 50% of households in Indonesia are food crops farmers (mainly paddy, secondary crops, and horticulture). The total farm household (FHs) for food crops in the provinces vary from 46% to 78%. The highest levels of food crop farmers were in Maluku and Irian Jaya (Papua) Provinces at about 78%, while the lowest level was in Sumatra and Java at an average of about 47%.

Agricultural Census of 1983 and 2003 show the increasing number of land holding farm household, particularly food crops farm household (FCFH) recorded at 24,458,000 FHs increased to 27,446,000 FHs in 2003 (increased by 12.2%). The total number of food crops farm household by main islands. The national average of land control by the farmer household is 0.83 ha. The largest is Kalimantan Island at 1.98 ha, followed by Sumatra at 1.24 ha, and Sulawesi at 1.21 ha. **Table 2** shows the average land controlled by Land Holding Farm Household.

Table 2. Average land controlled by land holding farm household by main islands in 1993

No.	Province	Land Tenure ((x 10^{-6} ha)	Number of LHFH (x 10^{-6})	Average Land Controlled (ha)
1	Sumatra	5.885	4.765	1.24
2	Java	5.461	1.563	0.47
3	Bali & Nusa Tenggara	1.150	1.323	0.87
4	Kalimantan	2.393	1.207	1.98
5	Sulawesi	2.013	1.664	1.21
6	Maluku dan Irian Jaya	580	509	1.14
	Indonesia	**17.482**	**21.031**	**0.83**

Source: Agricultural Census 1993, BPS Statistics Indonesia

Land Tenure: Nearly 50% of farm households control less than 0.5 ha of land per household and only 22% control 0.5 – 1.0 ha of land per household. Farm households control two to three ha of land only at about 7.4%. **Table 3** below shows the Land Holding Farm Household (LHFH) by Size of Land Controlled in 1983 and 1993.

Given the diversity of land holding features in each island within the archipelago in addition to the problem of land fragmentation and land conversion, the most apparent impact is that the number of land holders (especially on Java Island) is increasingly larger and larger.

Table 3. Land Holding Farm Household by area of land controlled in 1983 and 1993

Size of Area Controlled (ha)	1983		1993	
	Total LHFH	**%**	**Total LHFH**	**%**
< 0,05	1,271,067	6.52	646,372	3.28
0,05-0,09	1,167,370	5.99	948,296	4.81
0,10-0,24	3,155,471	16.18	3,570,371	18.11
0,25-0,49	3,938,317	20.19	4,417,121	22.41
< 0,5	**9,532,225**	**48.90**	**9,582,160**	**48.60**
0,50-0,74	2,797,812	14.35	2,934,875	14.89
0,75-0,99	1,445,451	7.41	1,438,870	7.30
0,5 – 0,99	**4,243,263**	**21.80**	**4,373,745**	**22.20**
1,00-1,99	3,297,609	16.91	3,312,218	16.80
2,00-2,99	1,294,048	6.64	1,457,561	7.39
>3,00	1,134,312	5.82	988,122	5.01
Total	19,501,457	100.00	19,713,806	100.00

Source: Agricultural Census 1983 and 1993, BPS Statistics Indonesia

V. THE IMPACTS OF SMALL LAND HOLDER ON WUA'S MANAGEMENT

5.1. DEMAND FOR WATER USER'S ASSOCIATION

Among the variety of problems encountering the irrigation water management, the lacking of skill and funds for O&M of the main system has been obvious. In addition, the inability of the farmer to provide adequate fund for O&M of irrigation networks, low collection rate of O&M funds due to a number of technical, institutional and other non-technical problems are also most dominant. Consequently, the sustainability of irrigation schemes has been declining and eventually entailed with deferred maintenance. Therefore, it is highly important to put special attention on encouraging participation of the beneficiaries to work together through the locally organized association. In this particular context, for accelerating the progress and promoting more successful PIM, special attention has been prioritized for empowering the WUA.

5.2. BASIC PRINCIPLE OF WUA

Establishment of WUAs: In attempting to foster the participatory approach in irrigation water management at the farm level, since 1980s the government has been actively promoting the WUA as the forum where the farmers are organized to work mutually for managing irrigation water management at the farm level as efficient and as effective as possible. The basic principles of WUAs' establishment are: (1) Demands for working mutually through the management of the group; (2) Establishment based on the initiative of members, by members and for members; and (3) Consistent technical guidance from the government and other related institutions.

Operational Principles: The operational guiding principles of the WUAs among others are: (1) Managing the water at the farm level within the tertiary blocks (at an average of about 50 to 100 ha per unit) – depending upon the size of the tertiary block and other administrative boundary of the villages; (2) Operating and maintaining the tertiary or village irrigation systems effectively and efficiently; (3) Determining collecting and managing the resources contribution of the members in terms of money, in kinds, or in terms labor for sustaining the O&M performance of the schemes; (4) Conducting a continuous guidance for their members toward innovative irrigated agricultural implementation. These particularly refer to the newly established irrigation schemes where no such a WUA had been practiced before.

Present Status of WUA: Basically, there are three categories of the present state of the WUAs: (1) Already developed, for the WUA that has been fully in operation with legally bound status, or the legal status is being processed; (2) Still developing, for the WUA that is being in the process of establishment for technically and legally; and (3) Least developed category for the WUA that has been organized but it may have legal status but has yet had the full capacity to run the organization.

The three categories are currently summing up the national total of 33,078 WUAs, of which 2,660 WUAs are already having the full legal status, 26,835 WUAs are being processed, with the total coverage irrigation areas of 4,011,197 ha or about 36% of the total existing irrigation and drainage lands.

Future Requirement for WUA: With an assumption that the commanding area of WUA ranging between 50 and 100 ha or averaging at about 66 ha, the overall requirement for WUAs in Indonesia for 7,588,012 ha irrigation areas and 1,676,786 ha of drainage lands, would be at about 140,375 WUAs. Therefore, the present status of WUAs altogether at about 24% of the total demands.

Despite the current pilot schemes for larger irrigation schemes, in order to be able to organize the WUAs in the larger scope of services and geographical distribution, it is highly essential for the future program to establish and strengthen the organizational arrangement of the WUAs – for instance at the large schemes, at secondary level, or scattered areas – in terms of WUA's Federation (WUAF).

5.3. REVIEW ANALYSIS ON THE POTENTIAL LEVEL OF FARMERS' PARTICIPATION

Despite the establishment of such a large number of WUAs mentioned previously, it is evident that the effectiveness of their operation had been very poor. This had been suspected by the impacts of small land holding condition, which brought about farm incomes which are far from adequate for the farmers to fully participate in the irrigated farming activities.

Farm Budget Analysis: From analysis conducted by **Gany, 1978** (M.Sc. Thesis, Southampton University), it was concluded that the maximum size of land holding for irrigated paddies in Indonesia that could be performed by relying the family labor only is 1.72 ha per farm household. This size of land holding is slightly above the level of marginal subsistence farming. Any size smaller than this figure is potentially suffered from the risk of negative income, and hence not likely possible to contribute adequate financial or labor resources for securing sustainable O&M of irrigation schemes. In fact, the land holding category up to 0.50 ha per farm household – which dominates the irrigated land areas of the country at 48.60% – is considered to be marginal subsistence farming, and hardly expected to participate sharing any contribution for sustainable O&M. The land category of > 0.5 < 1.00 ha and of >1.00 <2.00 ha are currently stood at about 22.2% and 16.80 % of the total agricultural land of the country respectively.

From analysis of financial return, the same analysis concluded that the land holding category of >0.5 ha; 1.0 ha and 2.00 ha produces the net value of production of US$91.6; US$463.51; and US$1,119.53 respectively. These figures have been based on irrigated paddy at 1.30 cropping intensity, after deducting indirect costs such as materials and labor, and indirect costs such as taxes, home consumption, and yet, without imposing any irrigation service fees.

Potential Capacity for Farmer's Participation: Based on the above figures, a review of potential level of farmers' participation is further scrutinized by using some assumptions, including the basis for full participation for the land holding rounded (for simplification) to 2.00 ha per farm household. The size of commanding area for the WUA at 100 ha/WUA, while the average commanding area for water users' association federation (WUAF) at 1,000 ha per WUAF. The estimated potential level of participation for sustainable O&M have been based on farm budget analysis and empirical estimate (expressed in terms of magnitude between 10 and 100), at the magnitude of 20 for the land holding category of smaller or equal to 0.5 ha; the magnitude of 30 for the land holding category of >0.5<1.00 ha; the magnitude of 80 for the land holding category of >1.00<2.00 ha; and the magnitude of 95 for the land holding of >2.00<3.00 ha. The remaining capacity to participate in irrigated farming activity must be dedicated to non agricultural employment in the urban areas (seasonal urbanization). See **Figure 3** for analysis result of the farmers' potential capacity to participate on the sustainable irrigation O&M.

Form **Figure 3** below, it is apparent that the WUA's institution as amongst the important prerequisites for implementation of PIM suffers from a number of non technical constraints among others: (1) Too many farmers are involved as the member in the WUA under the small land holding condition. For illustration, a WUA with an average land holding of 0.50 ha would compose of 200 farmer households working in an area of 100 ha; in addition to the average capacity to participate at the magnitude of 20 out of 100, since they have to seek seasonal employment in the urban areas. For the national average of land holding at 0.83 ha/farm household, a single WUA of 100 ha command area, would involve about 120 farm households, with the capacity to participate at only about 30 out of 100, for they have to share their time for earning non-farming extra income in the urban area.

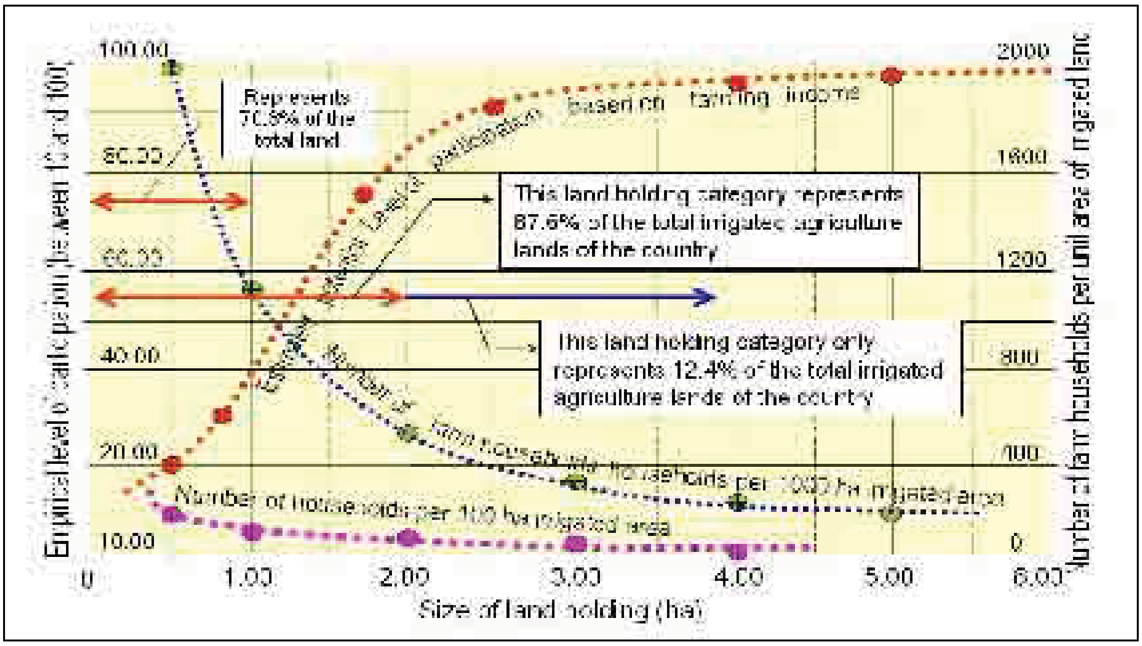


Figure 3. Analysis result of the farmers' potential capacity to participate on the sustainable irrigation O&M.

During their absences, their participation (in person) in the routine irrigation management are hardly possible – a size of irrigated farming organization, too diversified sosio-economic conditions, with low level of potential participation, which is far from manageable. If we take the optimum size of land ownership (2.00 ha/farm household) as the determinant parameter for establishing WUA, the number of members would be 50 farmers, which is reasonably manageable, however, such the optimum size of land holding only represent about 15% of the total national irrigated agricultural land.

Rationale of the Low Level of Participation: From the analysis results presented above, it is evident that the farmer's participation in O&M of irrigation is not merely the question of technical and economic perse', but far from those matters, there remains a complicated constrain on socio-cultural as well as organizational predicaments. The rationale of the currently low participation of the farmer is not only because of the farmers are unwilling participate, but it is quite a logic explanation that the farmer, under the extremely small land ownership, would naturally set up his own priority in mind, whether to participate partially or seeking non-farm extra-incomes elsewhere.

Alternative Measures to Address the Constraints: Under the diversified levels of education, experience, size of land-holding, and socio-economic as well as cultural backgrounds, it would not be easy to ask the farmer to participate voluntarily in O&M activities, on top of a hardly manageable number of members in the single WUA. In an attempt to address the constrains there are several alternative measures to mention, among others: (1) Transformation of paddy mono-culture (particularly for the land ownership smaller then 2.00 ha per unit) into diversified crops that have significant potential for higher financial returns – this alternative should be followed by consistent, post-harvest processes, storage and maintenance, as well as competitive market; (2)

Reformation and reclamation of land ownership plots and land administration into a sort of cooperative farming, operated by professional irrigated agricultural, and agro-based industries; (3) Consistent regulation and subsequent enforcement on the issues of land fragmentation and land conversion into non-agricultural utilization; (4) Consistent water saving and conservation implementation; (5) Provision of incentives to small land holder for cultivating high financial return crops, including encouragement of leisure agriculture in the rural areas for fostering the multifunctionalities of irrigated agriculture – with some leeway for flexibility to make adjustment with local circumstances. These alternative measures, however, are subject to further scrutiny and comprehensive studies, which are still widely opened for further interdisciplinary studies and experiments in the upcoming years.

5.4. LESSONS LEARNED FROM TRADITIONAL WUA

Learning from the traditional agricultural irrigated agricultural practices in Indonesia, it has been obvious that the existence of WUAs in this country had a long history. Among the most famous traditional WUAs are *"Subak"* in Bali Island, *"Keujreun Blang"* in the Special Province of Aceh; *"Tuo Banda"* in West Sumatra Province; *"Raja Bondar"* in North Sumatra Province; *"Mitra Cai"* in West Java Province; *"Dharmo Tirto"* in Central Java; *"Tudang Sipulung"* in South Sulawesi and several others to mention. In principle, all the traditional practices are embracing the similar democratic principle, mutual aids, cooperative working principles, consensus (oral or written), transparency, participatory, and other such a togetherness principles. The following illustration represents the Subak System.

The *"Subak"* Irrigated Agricultural Management System in Bali: The *Subak* system is an ancient irrigated-agricultural practice in Bali Island. Like most irrigation scheme in Indonesia, the *Subak* system also serves small-land holders where lowland paddy mono-culture is practiced in majority. The exact date of *Subak* was unknown; however, some stone inscription indicated that the *Subak* system was known to be part of the Balinese life since hundreds of years ago (*DPU Propinsi Bali, 1972*).

Principles of "Autonomous and Religious Ties of the *Subak* Practice". The *Subak* employs a principle of independence and religiously tied practices in managing irrigation system under the irrigated agricultural endeavor. The Subak members, thus, establish and maintain irrigation infrastructures through mutual cooperation through judicious and fair dispersion of obligation, right, and responsibilities. These activities are implemented through mutually agreed regulation which is referred to as the *Awig-Awig*. The organization structure of Subak is highly autonomous, representing the farmer from the grass-root to the highest organizational entity. The highest representation of subak member – which is known today as the WUA Federation – has long been practiced by Subak through the so called *Sedahan Agung*.

Coverage Area of Subak: The average area covered by one *Subak* organization is about 100 ha, depending upon the magnitude of the area covered by the irrigation command area of the *Subak* system. However, due to individual variation of the topographical condition, one *Subak* organization may cover an area in the range of 10 to 800 ha. Under the very special condition, one independent *Subak* area, however, may cover an area even smaller than 10 ha. *(Gany and Faisol, 1975:10)*. The boundary area of each individual *Subak* is usually formed by natural creeks, small valleys, small rivers or village roads. In the entire Bali Island, there are 1,283 independent *Subak* systems, with distinct irrigation infrastructure, farmers' organization and awig-awig regulation.

Lesson Learned from *Subak*: Despite the fact that the *Subak* system and its practices were invented long time ago, it is quite amazing to know that much of their techniques are still convertible to the modern practices that the people understand today. The more we can comprehend the traditional irrigated-agricultural practices the more we learn about their technicalities. In fact, there is a reason to believe that the traditional agricultural practices adopted by the *Subak* organization were based on systematic observations. Today, there remains a lot more phenomend of the ancient agricultural practice – including PIM Principles – that need to be uncovered from tradidional WUAs in terms of scientific explanation.

VI. CONCLUDING REMARKS

Learning from experiences to implement the massive irrigation development program, Indonesia has now been concentrating its policy on efficient O&M of irrigation. Since 1987, the Government of Indonesia has formulated a set of policies for addressing fundamental issues related to the provision of financial support for O&M and other expenditures required for irrigation development and management.

After a long process, the Water Law No. 7/2004 about Water Resources has eventually been managed to be enacted; and subsequently followed by the Government Regulation No. 20/2006 about Irrigation. The regulatory instruments have been established with special consideration on the past experiences, and then the subsequent implementation will be based on the newly established legal and regulatory instruments.

Despite the establishment of a large number of WUAs, it is evident that the effectiveness of their operation had been very low. This had been suspected by the impacts of small land holding condition, which brought about farm incomes which are far from adequate for the farmers to fully participate in the irrigated farming activities.

From agricultural labor analysis, it was concluded that the maximum size of land holding for irrigated paddies in Indonesia that could be performed by relying the family labor only, is 1.72 ha per farm house hold. This size of land holding is slightly above the level of marginal subsistence farming. Any size smaller than this figure is potentially suffered from the risk of negative income, and hence not likely possible to contribute adequate financial or labor sources for securing sustainable O&M of irrigation schemes.

The farmer’s participation in O&M of irrigation is not merely the question of technical and economic perse’, but far from those matters, there remains a series of complicated constrains on socio-cultural as well as organizational predicaments. The rationale of the currently low participation of the farmer is not only because of the farmers are unwilling participate, but it is quite a logic explanation that the farmer, under the extremely small land ownership, would naturally set up own priorities, whether to participate partially of seeking non-farm extra-incomes. Logically, the remaining capacity to participate in irrigated farming activity shall be dedicated, in lieu to non agricultural employment in the urban areas, which entailed seasonal urbanization.

Under the diversified level of education, experience, size of land-holding, and socio-economic as well as cultural backgrounds, it would not be easy to ask the farmers to participate voluntarily in irrigation management, on top of a hardly manageable number of members in the single WUA. In an attempt to address the constrains there are several alternative measures to mention, among others: (1) Transformation of paddy mono-culture (particularly for the land ownership smaller then 2.00 ha per unit) into diversified crops that have significant potential for higher financial returns – this alternative should be followed by consistent, post-harvest processes, storage and maintenance, as well as competitive market; (2) Reformation and reclamation of land ownership plots and land administration into a sort of cooperative farming, operated by professional irrigated agricultural, and agro-based industries; (3) Consistent regulation and subsequent enforcement on the issues of land fragmentation and land conversion into non-agricultural utilization; (4) Consistent water saving and conservation implementation; (5) Provision of incentives to small land holder for cultivating high financial return crops, including encouragement of leisure agriculture in the rural areas for fostering the multifunctionalities of irrigated agriculture, with some allowance for flexibility to make adjustment with local condition. These alternative measures are subject to further scrutiny and comprehensive studies, which are still widely opened for further interdisciplinary studies and experiments in the future.

Concerning the traditional irrigated agricultural practices, it has been obvious that the existence of WUAs in this country had a long history. In fact, all the traditional practices are embracing the similar democratic principle, mutual aids, cooperative working principles, consensus (oral or written), transparency, participatory and other such a togetherness principles. In reality, a number of experiences may be adopted from the traditional practices, including the principle of WUA Federation (in terms of *Sedahan Agung*).

It is expected that through the accelerated efforts, to address the constrains of small land holder along with appropriate incentives for encouraging greater participation of water users on the O&M, and making better use of staff resources, the **participatory irrigation management** will be more successful, and hence attaining the fully sustainable irrigation systems as well as sustainable water resources development and management.

BIBLIOGRAPHY

1. Asian Development Bank (ADB), 1996. Toward Effective Water Policy in the Asian and Pacific Region.
2. Bappenas, PU, JICA, 1993. FIDP – The Study for Formulation of Irrigation Development Program in the Republic of Indonesia.
3. Booth, Anne.1987. Irrigation in Indonesia, Part I and II. Bulletin of Indonesian Economic Studies (Vol. 13 No. 3.4.).
4. Departemen Pekerjaan Umum dan BAPPENAS, 1982. Water Resources for Sustainable Use in Indonesia. Proceedings of the International Seminar Sponsored by National Planning Agency and Ministry of Public Works, Cisarua, Bogor, October 29-November 1, ’92.

5. Departemen Pekerjaan Umum dan BAPPENAS, 1982. Water Resources for Sustainable Use in Indonesia. Proceedings of the International Seminar Sponsored by National Planning Agency and Ministry of Public Works, Cisarua, Bogor, October 29-November 1, 1992.
6. Gany, A.H.A. and Zakaria, Ir. F., 1975 *Persubakan di Bali* (Suatu Laporan peninjauan, untuk studi perbandingan dengan permasalahan pengairan di Lampung). A Report for the Provincial Government of Lampung, 1975.
7. Gany, A.H.A., 2001. Subak Irrigation System in Bali: An Ancient Heritage of Participatory Irrigation Management in Modern Indonesia, Research Center of Water Resources, MPW, Bandung, Indonesia, 2001.
8. -------, 1994. Manajemen Sumberdaya Air Terpadu, Majalah Pekerjaan Umum edisi Khusus No. 03/1994/XXVII.
9. --------, and Halli, S.S., 1993. Land Development and Transmigrant Farmers in Southern Sumatra, Indonesia. In International Migration. Quarterly Review Vol. XXXI No. 4, 1993. International Organization for Migration (IOM), PO Box 71, 1211 Geneva, Switzerland.
10. -------, 1989. Field Water Management Impacts on the New Irrigated Area. In Rydzewski J.R. (ed), Irrigation, Theory and Practice, John Wiley and Son. Ltd. & Pentech Press.London.
11. -------, 1978. Comparison of Estate and Small Holder Irrigation Projects in Their Impacts on Rural Development. M.Sc. Thesis, Southampton University, U.K., Southampton, October 1978.
12. Grader, C.J., 1960. *The Irrigation System in the Region of Jembrana*, Bali, Studies of Life, Thought and Ritual. Selected Studies on Indonesia, Vol. V. Les Editions A. Manteau S.A., Bruxelles W. van Hoeve Ltd. The Hague and Bandung. Edited by W.F. Wertheim et. al.
13. IPB, and University of Udayana, 1974. *Subak, Organisasi Tata Guna Air pada Tingkat Desa di Bali*, Institute of Agriculture Bogor, And University of Udayana, Bali, November 1974.
14. Park, Kee Sung, 1976. *Subak Irrigation System in Bali, Indonesia.* Japan International Cooperation Agency (JICA), 1976.
15. Republic of Indonesia, 2004. Laws No. 7/2004 regarding Water Resources.
16. Republic of Indonesia, 2006. Government Regulation No. 20/2006, regarding Irrigation.
17. Teken, I.B., 1967. *Organisasi Pengairan Pedesaan Subak di Bali*. A case study: Subak in Desa Luwus, Tabanan, Bali., Bogor Institute of Agriculture.
18. Winaya, P. Djapa, 1973. *Organization of Water Association in Bali.*, A paper specially prepared and presented as a lecture for the American Students from the Lewis and Clarke College, Oregon, U.S.A., at the Udayana University, Denpasar, Bali.

IRRIGATION MANAGEMENT TRANSFER: MONITORING AND EVALUATION CONCEPTS AND APPROACHES

A. Hamdy[1]

ABSTRACT

Irrigation Management Transfer (IMT) from Government to users has brought many benefits including improved management, lower overall management costs and empowerment of local people that has multiplier effects in community – building and quality of life.

Experience gained and learned lessons indicate clearly that institutional reforms towards participatory management of irrigation systems require a learning process that should involve representatives of key stakeholders.

Different stakeholders will have different and potentially competing interests in the process, outcomes and possible impacts of the reform and, accordingly, IMT creates a new form of organization where much uncertainty is involved. Monitoring and evaluation (M&E) can play an important role in reducing the level of uncertainty about IMT and in bringing to light objectives and timely information about how IMT is being implemented, what outcomes are emerging and, eventually, what impacts are realized.

Evaluation findings can enable policy-makers to assess whether the reform was appropriate or not and to give realistic answer to the question: "Are we doing the right things or the wrong ones?" M&E together enable us to judge the IMT process, though it implies designing an M&E system that is complete, concise and valid. This is what will be highlighted and discussed in this paper.

INTRODUCTION

Irrigation development during the 20th century greatly expanded the world-irrigated lands from 48 million hectares to roughly 255 million hectares (17% of the world crop lands) that represent a phenomenal growth for increasing the potential to feed the world. The irrigated land produces one third of the world's food. Between 1961 and 1990, the area under irrigation increased by almost 100 million hectares. The annual growth rate of irrigated area exceeded 2% during the 1960's and 1970's. Today, the growth rate has slowed down to a moderate value of 0.8%. The medium variant estimates of world

1- Emeritus Professor - Water Resources Management – email: hamdy@iamb.it

population growth, as indicated by the UN's world population (the 1992 version) indicate that from 1995 to 2020, the population will increase to 8.1 billion. According to FAO (1997), the share of world food production that comes from irrigated agriculture must increase from the present 34 to 45% in the year 2020. Achieving such a goal is fundamentally a matter of the way we are using and managing water in the irrigated sector as it globally receives more than 70% of the available water resources, but, unfortunately, with a very poor on-farm water use efficiency not exceeding 50%.

Indeed, by the 1970's, there was rapidly growing awareness that much more emphasis needed to be placed on irrigation management, which is an on-going learning process in many countries. Experiments in developing countries on converting government-managed irrigation systems to farmers' management have mostly taken place during the past two decades, and continue at the present time but, usually, much more time will be required before the fledgling farmer organizations are strongly functional and sustainable.

We believe that a set of vital elements are needed to manage irrigation systems effectively and sustainably, and some of them are identified in the following:

- clear and recognized management and responsibilities;
- irrigation infrastructure compatible with the water rights and local management capacities;
- adequate financial and human resources management;
- clear and sustainable water rights, and
- supportive accountability and incentives for the managing entities.

A realistic characterization of the situation where the State is the central actor of water management in the irrigation sector, confirms that those vital elements are partially or completely absent. These are the basic elements that led to a revolutionary approach in water management, from the State being a central actor towards a greater participation of other actors, including local governments, non-governmental organizations and, above all, the beneficiaries, the water users, i.e. the farmers.

The necessity for doubling water productivity for irrigated agriculture over the coming decades is strongly dependent upon having both a clearly defined water rights system in each irrigated region, as well as sustainable farmers' organizations for vastly improving irrigation water management.

Politically and technically, it has now been recognized that unless farmers are involved in operation, management and maintenance of irrigation system, the objective of increased utilization and production from irrigation commands cannot be realized.

Considerable efforts have been made in many countries of the world to implement participatory irrigation management (PIM) program in the last two decades. This is a trend of worldwide dimensions: as many as 25 countries in the world are actively engaged in irrigation management transfer programs (IMT) to farmers and every few months new countries are added to the list. However, in spite of such wide expansion in the implemented management transfer programs, little is known about the effectiveness of those programs and their impacts on the water use and its management in the irrigation sector.

Equally and for most countries, it is rare to find a complete analysis of management transfer impacts in terms of legal organizational factors and operational procedures in view of the perspectives of water users, the irrigation association, the irrigation agency and the national or state government. Indeed, evaluation of the results achieved by the newly established water user associations (WUA) is often lacking and, therefore, the possibility of improving the strategy selected is frequently missed. Therefore, the present paper will deal with monitoring and evaluation of irrigation management transfer in a more effective way.

IRRIGATION MANAGEMENT TRANSFER: AN OVERVIEW

Centralized irrigation administration has become a financial burden for many countries.

In addition, so many irrigation systems are deteriorating which penalizes agricultural productivity. The prognosis is that these countries will be unable to meet the food demands of the growing population.

Since the early 1970's, awareness about the necessity of recognizing the farmer beneficiary a greater role in irrigation systems has increased. Both, the Asian Development Bank (1973) and the International Bank for Reconstruction and Development (1985) stressed the importance of local grassroot organizations. The U.S. Agency for International Development (1983), in an assessment of irrigation projects in developing countries, concluded that the major emphasis was on construction, while the social, institutional and management aspects were largely neglected. In addition, the U.S. General Accounting Office (1983) urged the establishment of Water Users' Associations that would perform routine maintenance on secondary canals, along with communicating the needs of farmers to project officials. By the 1990's, considerable emphasis was being given by international donors and leading agencies to establishing farmers' organization on various irrigation projects in a number of countries (Ostrom, 1992) with the adoption and the implementation of irrigation management transfer programs (IMT).

In recent decades, PIM programs and IMT policies have become a worldwide phenomenon. At the national levels, when looking at the implementation of PIM programs and the adoption of IMT policies, we find three typical situations:

- countries where PIM policies have a long tradition and where the management by farmers is considered the normal way of managing an irrigation system. Example of such countries are the industrial countries such as the U.S.A., Australia, New Zeeland and Northern European countries (Spain, France, Italy);
- countries where substantial efforts have been made in recent years to implement PIM policy and IMT strategies whereby the majority of the irrigation systems have been transferred to farmers' associations, for example: this is the case of Turkey, Mexico, Albania and the State of Andhra Pradesh in India;
- countries where governments seem to have some reservations about the rapid implementation of PIM policy and prefer to assess the feasibility of implementing

such policies in selected areas. Such countries are predominant in many third-world countries in Latin America, Asia, Africa, and MENA regions.

A comprehensive study funded by the German Government (Vermillion, 1996), reports that irrigation management transfer will be acceptable to farmers' organizations and result in sustainable local management only where the following arrangements are in place:

- the transfer is cost-beneficial to the majority of farmers (at least in the long term);
- social divisions are not serious enough to disrupt communications and decision-making between farmers;
- clear and sustainable water rights are vested in the managing entity, i.e. the farmers' organization;
- the policy transfer clearly designates responsibility, authority, supportive accountability, and incentive mechanisms at the operational level, including a clear designation of responsibility for long-term maintenance and rehabilitation;
- irrigation system infrastructure is appropriate for local management capabilities;
- adequate human, financial and information resources are available to support local management.

WHAT IS IMT?

We define irrigation management transfer (IMT) as the turning over of authority and responsibility to manage irrigation systems from government agencies to water users associations (WUA's). This involves the following two key-roles:

- the authority to define what the irrigation services will be;
- the authority to arrange for provision of those services.

The key services are generally water delivery and maintenance of irrigation infrastructure, although there may other services desired after transfer, such as technical consultation, design and construction, information, extension, credit, marketing, etc. After IMT, water users should have the authority, through democratic means, to define what services should be provided, what their objectives and targets should be and what service performance standards are acceptable.

According to Kloezen and Samad (1995), there seems to be a consensus that irrigation management transfer program should involve at least three contingent strategies: improvement of support services delivery; empowerment of farmers and farmers organizations; and irrigation system long-term financial viability.

IMT AND ITS WIDESPREAD PROGRAMS: THE DRIVING FORCES

Several reasons are rapidly pushing to hand over the IMT from the government authorities to the beneficiaries: the farmers.

In a majority of countries, the primary reason for undertaking irrigation management transfer is to significantly reduce public expenditures for irrigation recurring costs.

Equally, the disappointing performance of irrigated agriculture is due to the following four major reasons (Geiger, 1995):

First, the under-utilization of irrigation facilities, the areas actually irrigated has usually fallen short of those projected;

Second, poor system management: most systems are constructed by the same agencies that are subsequently in charge of their operation; these agencies might be capable of construction, but they are not always skilled in responsive management;

Third, the gap between the bureaucracy and the beneficiaries is often too distant to enable efficient and responsive management;

Fourth, inadequate maintenance of infrastructure: generally, insufficient funds for maintenance as well as the provision of adequate funds usually do not result in proper maintenance.

Besides such reasons, there are other driving forces and motivations for irrigation management transfer, some of them being:

- the perception that public irrigation agencies lack the incentives and responsiveness to optimize management performance;
- the farmers' interest in effectively contributing in deciding on the cost-efficiency of irrigation and in preventing the deterioration of irrigation systems;
- the well-recognized management system that is more accountable to farmers will be more equitable and responsive provided that the cost service provisions be borne by the beneficiaries.

Indeed, the rapid expansion of irrigated areas in the world after the Second World War was not matched by a corresponding increase in funds available for managing irrigation systems. Financial pressures on governments, lack of sufficient funds allocated to irrigation management, widespread deterioration and poor performance of irrigation systems, failure to collect sufficient water charges from farmers, commercialization of agriculture, and the general trend of liberalization and privatization are all factors which have led to such wide adoption of IMT programs in many countries.

IMT: MAJOR ISSUES REQUIRING SPECIAL ATTENTION

In developing IMT policy and program, several issues will raise that may require analysis, experimentation and negotiation. Policy issues are generally about: *What the future will look like?* Program issues are generally about *: How to get from the present to the future?*

The following are the four most common and important IMT policy issues, (Vermillion and Sagardoy, 1999):

- What functions should be transferred, to what organizations?
- How will irrigation O&M, rehabilitation and modernization be financed after IMT?
- What policy and legal changes need to be made to support transfer?
- What changes should be made in public agency mandates as a result of transfer?

Regarding the IMT program, the previous authors outlined the following most common four issues:

- o How should the local organization be related and prepared to take over management?
- o What improvements in infrastructures and management need to be made?
- o How should agency reforms be designed and carried out?
- o How can an effective system of monitoring and evaluation be set up?

Monitoring and evaluation may provide feedback that leads to modifications in design of the program.

IMT PROGRAMS: LESSONS LEARNED

The most striking lesson from an analysis of transfer projects is the strong resistance by governmental irrigation agencies towards irrigation management transfer to organized farmers. In some cases, irrigation staff do not believe (or think they cannot afford to believe) that farmers are capable of managing an irrigation system, even though there may already be successful farmer-managed irrigation systems in the country. Indeed, irrigation management transfer, if properly executed, could benefit both the farmers and the government. However, it needs to be carried out in a carefully staged process, adequately addressing farmer's needs and aspirations. Furthermore, there is an urgent need for a thorough strategic orientation of government agencies from direct management organizations to support services and regulatory organizations. Equally, for irrigation management transfer to be sustainable, emphasis should not be only on the turnover process, but, there should be an economic basis that makes irrigated agriculture profitable to farmers. To ensure the management systems after turn-over, complementary policies have to be integrated with irrigation management transfer programs.

IMT is potentially sensitive and there may be opposition to it by influential groups such as irrigation agencies and politicians. Therefore, it may be necessary for the decision to be made at the highest levels of government. If this level of support is not possible, the country may not be ready to adopt an IMT policy, even if it is found to be necessary and technically feasible. The lessons learned indicate that, sometimes, what is politically feasible (e.g., enhancement), overrides what is really needed (e.g., reform), perhaps due to political resistance from vested interests. Due to pressure from donors, technical assistance agencies and internal interest group, management transfer program may be adopted in environments where it may not be feasible. Planners must determine whether the existing social and institutional situation is conducive to the creation of viable local organizations to provide the water service.

The aforementioned requisites call for a strong political support for irrigation management transfer that greatly facilitates the implementation process. In addition, this political support helps considerably in passing necessary legislation for giving legal authority to organized farmers to assume the management responsibilities for irrigation system (Hamdy, 2004).

The irrigation management transfer experiences of several countries (Skogerboe et al., 2002) indicate that irrigation management transfer is still in the policy or program formulation stage in many countries. Numerous issues need to be addressed and many problems need to be discussed and resolved: policy options that can help resolving some of the major roadblocks to successful transfer program should be developed. However, such policies and strategies should be fundamentally based on appropriate monitoring, evaluation and feedback programs.

In this regard, Geijer (1995) reports six essential conditions for successful irrigation management efforts: strong high-level political support; clear national policy direction; legal basis for new managing entities; economic benefits to the farmers; well defined water rights at the system and farmer levels; and functional irrigation facilities (infrastructure).

Among the learned lessons there is the one concerning the water resources management and what should be the role for a governmental agency. For irrigation management transfer programs and considering the evolutionary role for a governmental agency, the following can be stated:

“The future role of irrigation agencies should not be operation and maintenance, but rather technical assistance in implementing water resources policies”

An irrigation agency should evolve into a water resources management agency. Thus highly qualified staff must cover a wide range of disciplines.

The water resources management agency should sustain a strong capability in irrigation water management to provide the technical assistance to water users’ organizations for irrigation system improvement. The remodelled agency should also develop a very strong capability for water resources investigations including groundwater as well as surface water, along with both water quantity and quality. However, such much greater role, other than operation and maintenance, requires some serious thoughts on the initial steps in transitioning from an irrigation agency to a water resources agency, such as:

1) How to enhance the capabilities of the irrigation agency staff?
2) How to handle staff redundancy, particularly for lower level staff?
3) What collaboration with other organizations should be fostered?
4) How to provide technical assistance for agricultural development?

Regarding the major tasks the national water resource management agency has to develop, it implies that the agency must be multidisciplinary with some individuals having background in the social sciences and others in the physical sciences. More important is to develop an interdisciplinary teamwork that should methodically be pursued in both the planning and implementation functions. This is the most difficult task, particularly in a public agency where it is difficult to determine the services of an employee. Thus, national consultants should be used to establish guidelines for interdisciplinary teamwork, as well as, periodically, to participate in the monitoring, evaluation and feedback regarding the IMT program.

MONITORING AND EVALUATION: BASIC CONCEPTS

Monitoring and evaluation are tools for assessing the performance of interventions; in this case, the transfer of irrigation management from government to users. Both are done so that the policy makers and planners can find out how a new program is being implemented at local levels and what its results are.

Monitoring and evaluation will help in analyzing all the system parameters and bringing about changes in operations to the desired standards, to obtain maximum benefits from the project. It also ensures the effective and efficient implementation of the plans. Furthermore, through monitoring and evaluation, other stakeholders, like farmers and local government officials, can know how the program is affecting them. Finally, monitoring and evaluation are the tools of the WUA's enabling them to keep track of happenings in the system and induct changes on day-to-day basis, which would help the organizations to modify the existing irrigation policies and plans to achieve the main objectives for which the association is formed and the system is created. Indeed, regular monitoring is essential not only to assess the progress but also to take corrective steps wherever needed.

Monitoring and evaluation, generally, distinguishes between *Inputs, Process, Outcomes and Impacts* of some intervention or reform programs:

- *Inputs:* can be policies, legislation, plans, financing, human resources and training activities. They are all resources that are mobilized to drive the intervention.
- *The implementation process* is the series of actions and decisions that should be done in order to make the program happen and achieve the objectives and targets specified by reforms.
- *Outcomes* are the immediate or direct effects of an intervention.
- *Impacts* are the ultimate output of reform or intervention.

Both monitoring and evaluation seek to answer the question: *how well are we doing?* However, a clear differentiation should be made between monitoring and evaluation.

WHAT IS MONITORING?

Monitoring generates information for analysis, keeps watch on changes that take place in the physical system, assesses the condition of the components of the system and provokes thinking that well help improving the working of the system. It also helps in verifying whether assumptions made and parameters adopted in the formulation of the operational plan for the system are realized during the actual operation, and if any modifications are necessary**.** It helps in identifying constraints so that timely remedial measures are taken. Monitoring is a valuable tool for improving systems management and efficiency.

The broad steps in monitoring could be outlined in:

- reviewing planned progress;
- identification of constraints;
- taking timely action; and

- planning for future course of action.

UNDP (1997) gave the following definition: Monitoring is a continuing function that aims primarily to provide program or project management and the main stakeholders of an on-going initiative with early indications of progress or, lack thereof in the achievement of program or project objectives.

Monitoring accepts existing objectives and targets as given and assesses to what extent these are being implemented and it asks: *"Are we doing things right?"* If the results of monitoring are properly reviewed and incorporated into the on-going reform process, it should help reformers to make improvements in planning and implementation or, perhaps, to change course.

MONITORING: BASIC CHARACTERISTICS

Any monitoring system should have the following basic features:

- o simple to operate, relatively fool-proof and capable of producing data of acceptable accuracy with acceptable speed;
- o appropriate to the purpose;
- o flexible in application and adaptable to the needs of the project, depending on its size and characteristics;
- o monitoring procedure should be as consistent as possible within existing staffing patterns, data collection, procedures, and
- o it allows judgments to modify the operation plan (OP), if necessary.

The approach in monitoring should be specific, so that the output is visible. The whole process of monitoring has to address itself to four questions. They are presented in (Fig. 1):

I. *What* : which activity to be taken for monitoring?

II. *Who* : who will do this?

III. *When*: at what stage of the activity or intervals/periods, the information is to be collected?

IV. *Whom:* collected information is to be sent to whom?

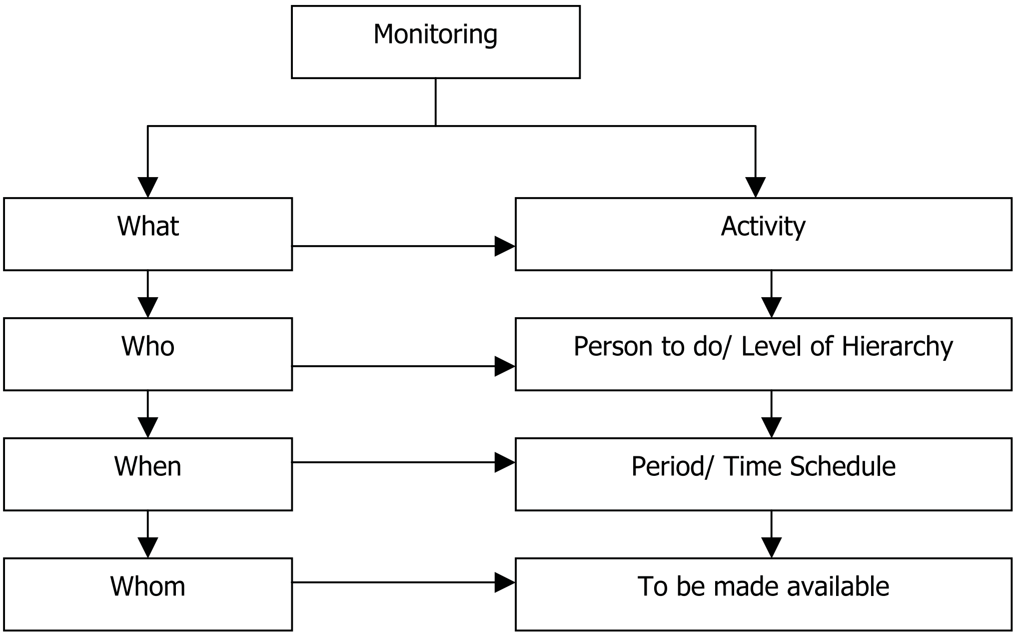


Figure 1. The monitoring chart

In addition, it is of paramount importance that any monitoring mechanism has to gather information regularly, to collocate the data gathered, to provide the compiled data to the concerned for taking appropriate decision, and where required, to follow up for the implementation of the decision.

Also, it is recommended to carry out monitoring with the involvement of each target group. For example, a funding organization may view monitoring and evaluation (M&E) as a way to improve the effective use of funds as a means to monitor progress in implementation.

EVALUATION

UNDP (1997) defines evaluation as a time-bound exercise that attempts to assess systematically and objectively the relevance, performance and success of on- going and completed programs and projects**.**

It is a process to methodically analyze the functioning and performance of an irrigation system and the organization managing the system. It provides an opportunity to identify the components that are not performing well.

Evaluation focuses on determining whether or not the intervention is producing the intended outcomes and impacts its proponents expect. Evaluation asks: *"Are we doing the right things?*

The purpose of evaluation is to quantify the achievements and identify the areas of deficiency to enable to take up corrective steps. Findings from an evaluation can enable policy makers to assess whether the reform was appropriate or not.

Together, M&E enable us to determine whether successes or failure are the results of what was done, how it was done or other extraneous factors.

APPROACHES TOWARD M&E

GOAL ORIENTED M&E

Examples of this approach are Casley and Kumar (1988) and Murray-Rust and Snellen (1993). This approach translates the goals and objectives contained in official policy documents into specific indicators for M&E. It is regarded as the most conventional and, in some ways, is shown to be the simplest approach. This approach tends to be, primarily, quantitative, relatively efficient and it can be applied over a wide area. However, its mean weaknesses are that it tends to have blinders against detecting unexpected results, and it undervalues outcomes that are not specified in policy goals.

MULTI-PERSPECTIVE M&E

This approach may involve representatives of all key stakeholders as equal partners in the design, identification of indicators, implementation and analysis of results of an M&E system. It tracks progress and new developments according to these diverse perspectives. It tends to involve multiple methods and more opportunities for involvement of stakeholders in information gathering and review of results and thereby seems to be more comprehensive than goal-directed M&E. However, such approach is rather costly and implies the establishment of clear priorities to avoid having a very long list of indicators. Examples of this approach are Narayan (1993) and Gosselink and Strosser (1995).

The multi-perspective M&E is often used in combination with goal-directed M&E. This can complement the strength of other methods to generalize with the strength of multi-perspective M&E to understand local perspectives and dynamics.

PARTICIPATORY MONITORING AND EVALUATION (PME)

PME is a concept which recognizes the fact that farmers and their organizations have a prominent role in the process of irrigation water management and utilization to optimize irrigation use efficiencies, improve agricultural production and improve the economic well-being of all farmers, particularly the tail-end farmers within the command area.

Participatory and participation are words that mean:

- an active process where farmers take initiative and assert for autonomous functioning;
- sensitization of farmers to increase their ability to respond to the needs of the irrigation system management and operations;

- o spontaneous and voluntary involvement for self-determined improvement through proper maintenance and operation of the system;
- o fostering a dialogue between the irrigation authorities and other farmers' organizations for proper management, and
- o a voluntary contribution by farmers in the form of money or material without lacking part in decision-making.

Participatory monitoring and evaluation is an adoptive, dynamic, exciting and creative approach for sustainable development of WUA. It is a combination of a purposeful concept, packed-up method in implementing the activities and has participatory tools for information gathering. It also needs commitment of the organization on: sustainability, self-help and personal involvement.

This form of M&E has the potential to produce more in-depth understanding of local knowledge and circumstances than does a uniform goal-directed approach. It has greater potential to discover the unexpected and the perception of local people.

M&E: GUIDING PRINCIPLES

It is complicated to provide specific guidance in how to design an M&E system for IMT program since every country that decides to follow a PIM policy has a different set of objectives. Any evaluation of the program must take into consideration such objectives in designing the corresponding M&E system. Vermillion and Sagardoy (1999) make some general recommendations on how to design such a system:

1) Follow a minimalist approach – only use indicators that satisfy the following criteria:
   - o they are key aspects of implementation (i.e. performing tasks and meeting targets);
   - o they inform about essential outcomes and impacts;
   - o they do not exceed the optimal amount of information that can practically be absorbed by planners;
2) Select indicators which are information efficient;
3) Distinguish between top and bottom directed needs for monitoring;
4) Distinguish between those few indicators for which data must be collected from all sites versus those for which sampling may be sufficient.

ORGANIZING AND IMPLEMENTING M&E: BASIC STEPS

Key decisions in developing and implementing a monitoring and evaluation system is shown in Fig. 2. It shows a series of eight key steps or considerations that need to be made to design and implement a monitoring and evaluation system. This is not a blue print and the steps do not have to be done in consecutive order, as presented here. They may be done simultaneously or in different order, as may be needed in some settings (Vermillion, 2000).

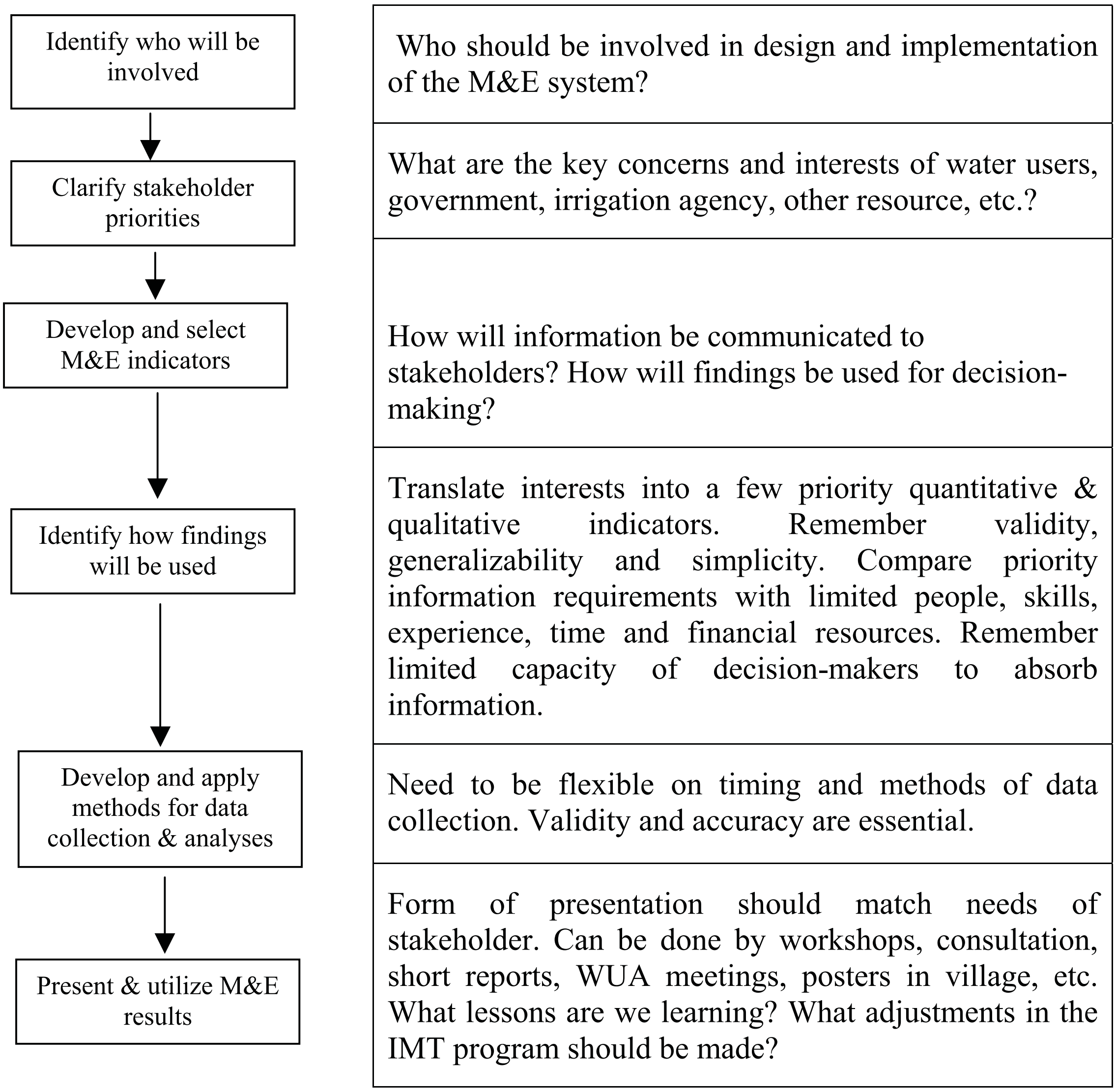


Figure. 2 Key decisions in developing and implementing a Monitoring and Evaluation System

On the globe, experiences gained emphasized the importance of information in guiding the design and implementation of M&E system. Major weights should be given to the validity, relevance of information and to its efficiency. This will help the organizers of the M&E systems to have appropriate indicators easy to interpret for each important aspect of the program inputs, implementation, outcomes and impacts that need to be monitored or evaluated.

In a more participatory reform process, key stakeholders will generally play some role in designing the M&E system, especially in identifying indicators and using M&E findings to make decisions about the reforms.

Following a participatory M&E process will give the target groups a genuine input into developing indicators to monitor and measure changes as well as allowing for the M&E process to be owned by the group, rather than imposed on them by outsiders.

To facilitate this task, which is a relatively difficult one, organizers of M&E should not select too many indicators or try to collect more data than can be managed and presented to busy people.

Often the irrigation agency provides staff who conduct monitoring and evaluation. In some cases, where IMT is politically sensitive and controversial, it may be better for a third party, "Universities or NGO's", those neutral bodies not directly involved in implementing the IMT program, to conduct the M&E program. Having neutral partners, who have training in M&E or research methods, conduct M&E data collection and analysis, may ensure greater independence, objectivity, transparency and credibility of the findings.

Monitoring and evaluation IMT system is generally facing the problem of how the results are utilized to make changes in the program. In this regard, it is advisable that before the M&E system is set up, there should already be organizations, committees, communication channels and decision-making bodies to receive and deliberate on the findings. Further, it is recommended to involve farmers in committees that review M&E findings and make IMT timely adjustments and enhancements when needed.

M&E: DEVELOP AND SELECT INDICATORS

Before deciding on the indicators to be selected to be used for monitoring and evaluation a two-step process should be followed:

The first is to determine what are the key interests and concerns of the different stakeholders about the implementation outcomes and ultimate impacts of IMT. This is a preliminary step toward identifying indicators for M&E;

The second is to identify how the findings from M&E will be used. This step helps preventing M&E organizers from producing an overload of information that is unnecessary, irrelevant, and excessive and not responding to the stakeholders' interest. For instance, IMT planners and technical experts may be most interested in monitoring the timing and cost of implementation, including such aspects as how many WUA's have been organized, how many schemes have been turned over, how much area has been rehabilitated, etc.

The policy makers and donors may be more concerned with out comes and impacts, such as ability of WUA's to take over O&M tasks and effects of IMT on the quality of O&M.

Farmers will have other different interests mostly concerning the effect of IMT on their cost of irrigation and the productivity and profitability of irrigated farming.

Once the M&E organizers have identified key information needs of stakeholders, the next step to do is to translate these into measurable indicators. This can be done in a two-step process: the first, is to identify a core set of performance criteria using the broad and outcome objectives for implementing IMT program. The following are probably the five most common and important objectives for implementing IMT program:

- o to provide essential rights and authority to WUA's to take over management;
- o providing training and other support to facilitate creation and development of WUA's;
- o to make physical improvements to irrigation infrastructure;
- o to transfer management responsibilities to WUA's;
- o to provide training and new capacity building to the irrigation agency.

The most commonly mentioned outcome objectives for IMT are :

- o to contain or reduce the cost of irrigation;
- o to achieve financial self-reliance of irrigation system;
- o to improve the quality of water delivery performance;
- o to improve the quality of system maintenance.

In the following steps, specific measurable indicators are derived from the set of performance criteria as given in Table (1). The table illustrates a simplified guide and is not an exhaustive inventory of all possible objectives, performance criteria and indicators for any given location.

Table 1. Performance criteria and INPIM M&E indicators

Indicator listing	Performance criteria	Number of indicators
Process Indicators	-Water Users'Associations (WUA's)	23
	-Operation and Maintenance (O&M) Activities	11
Totally: 63 Indicators	-Irrigation Department	8
	-PIM Policy and Reform Program	21
	-Water Users' Associations (WUA's)	23
Outcome Indicators	-Irrigation Operation and Maintenance (O&M)	14
	-Irrigation Department	5
Totally: 47 Indicators	-PIM Program and Irrigation Sector	5
Impact Indicators	-Irrigated Agriculture	11
	-Rural Livelihood	5
Totally: 24 Indicators	-Environmental Impact Indicators	8

In this regard, as a reference, the combined list of potential M&E indicators and performance criteria for IMT or participatory irrigation management generated by participants at the *Fifth International Seminar on Participatory Irrigation Management* held in Hyderabad, India on December, 1999 is recommended. The INPIM seminar listed the M&E indicators in the form of performance criteria as process, outcome and impact indicators.

As shown in Table 1, the indicators listed by INPIM are of a relatively high number amounting to 134, and covering the different proposed performance criteria. The different listed indicators proposed, related to each performance criteria, are cited by Vermillion (2000) in the JIID, INPIM publication: *"Guide to Monitoring and Evaluation of Irrigation Management Transfer"*. Monitoring and evaluation of the IMT programs does not require using such ample number of indicators, but it needs selecting the ones that satisfy the objectives of the program. The diversity of irrigation systems is large and any monitoring system may hardly be satisfactory for all of them. It would be more appropriate to develop evaluation systems for each main type of irrigation system. As an example, defining the objectives for the irrigation system operation is not an easy task.

Considering the most relevant objectives related to some specific systems - as reducing the losses of the irrigation system, satisfying crop irrigation requirements, distributing water timely, measuring the water delivered accurately - the indicators related to the objectives are given in Table (2).

Table 2. System operation objectives and related indicators

Objective	Indicators related to the objective	Time period for application of indicator	Remarks
1. Reducing the losses of the irrigation system.	Total losses = Total volume of water supply at the head of the system - Total volume of water delivered at farms	decade monthly peak demand, annually	Total losses include operational losses
	Efficiency of the distribution system* $=1-\dfrac{Water\ losses}{Total\ volume\ of\ water\ \ supplied}$	Decades monthly peak demand, annually	Time evolution of efficiency provides relevant information
2. Satisfying 100 % of crop irrigation requirements	Relative irrigation supply** $=\dfrac{Irrigation\ water\ delivered\ at\ farm \times farm\ efficiency}{net\ irrigation\ requirements}$	decades peak demand, annually	The critical period is peak demand
	$\dfrac{Canal\ capacity}{Peak\ Irrigation\ demand}$	Peak period	It should be determined for all canals
3. Distribute the water timely	$\dfrac{Number\ of\ irrigations\ given\ per\ main\ crops}{Number\ of\ irrigations\ required\ per\ main\ crops}$	End of irrigation season	It should be determined for main crops
4. Measure the water delivered accurately	$\dfrac{Total\ volume\ of\ water\ delivered\ at\ farm\ level}{Total\ number\ of\ hectares\ irrigated}$	Monthly, seasonally, annually	The total volume should be the sum of the volumes delivered at every farm
	$\dfrac{Number\ of\ offtakes\ calibrated}{Total\ number\ of\ offtakes}$	Annually	It provides an indication of the capacity of the system to measure water

* In addition to the efficiency of the system it will be useful to determine the efficiencies of the delivery canals using the same type of equation

** This indicator is sometimes expressed in somewhat different forms

Source: Sagardoy (2203).

LESSONS ABOUT MONITORING AND EVALUATION

Over the years, the monitoring and evaluation strategies have evolved toward the combined use of internal monitoring and external monitoring evaluation with attention paid to the development of user associations' capacities to monitor their own performance.

The review of various monitoring and evaluations led to the identification of some key lessons:

1. All key stakeholders must participate in the development of the various elements of the monitoring framework. This helps in identifying the projected use of monitoring information and the various ways that findings will be communicated to stakeholders. It also ensures that only relevant and useful information is collected.
2. When various monitoring activities are carried out by different stakeholders, it is important for them to be conducted on the basis of the same indicators and parameters, so as to allow for comparisons and to benefit from the complementary nature of the information collected.
3. Monitoring data from previous projects and baseline information must be used to inform the development of the performance review framework.
4. Monitoring must be iterative and thus monitoring frameworks must be tested through field research before they are made official.
5. Developing a comprehensive monitoring strategy useful for decision-making, while keeping it simple enough to guarantee its ongoing implementation, requires that all stakeholders agree on a limited number of key areas to monitor.
6. The overall performance of the user associations needs to be continually assessed, internally and externally, to ensure their adequate development and the maintenance of their capacities over time.
7. The user associations should be empowered to resolve problems themselves. Otherwise their role is limited to the collection of data to be used by other organizations.
8. The incorporation of project-level monitoring data into a national monitoring system remains a challenge for many government agencies.

REFERENCES

1. Asian Development Bank. 1973. Proceedings regional workshop on irrigation water management. Asian Development Bank, Manila, Philippines.
2. Casley, J. D. and Kumar, K. 1988. The collection, analysis and use of monitoring and evaluation data. Baltimore, Maryland: World Bank and Johns Hopkins University press.
3. FAO. 1997. 1996 Production year book, vol. 50, Rome, Italy, pp.282.
4. Geiger, J.C.M.A. (Editor). 1995. Irrigation management transfer in Asia. FAO and IIMI, RAP publication 1995: 31, Bangkok, Thailand. pp.248.

5. Gosselink, P. and Strosser, P. (1995). Participatory rural appraisal for irrigation management research: lessons from IIMI's experience. IIMI working paper, n. 4, pp. 294-308.
6. Hamdy, A. 2003. Participatory irrigation management: gaining benefits and rising problems. Options Méditerranéennes, CIHEAM/MAIB, Italy, series B, n.48. pp.3-20.
7. International Bank for Reconstruction and Development (ICRD, or "World Bank"). 1985. Tenth annual review of project management in Sri Lanka's irrigation schemes. World Bank operations evaluation dept., Washington, D.C.
8. Kloezen, W.H. and Samad, M. 1995. Synthesis of issues discussed at the international conference on irrigation management transfer. Wuhan, China, 20-24 September 1994. IIMI short report n. 12. Colombo, Sri Lanka: International Irrigation Management Institute.
9. Murray-Rust, H.D. and Snellen, B. 1993. Irrigation system performance assessment and diagnosis. Colombo, Sri Lanka: International Irrigation Management Institute, International Institute for Land Reclamation and Improvement and International Institute for Hydraulic and Environment Engineering.
10. Narayan, D. 1993. Participatory evaluation: tools for managing change in water and sanitation. World Bank technical paper, n. 207, Washington, D.C.
11. Ostrom, E. 1992. Crafting institutions for self governing irrigation systems. San Francisco: ICS press.
12. Sagardoy, J.A. 2003. Assessment and monitoring of participatory irrigation management. Options Méditerranéennes, CIHEAM/MAIB, Italy, series B, n.48. pp.21-32.
13. Skogerboe, G.V; Meskley, G.P. and Rifenburg, R.F. (Editors). 2002. Establishing sustainable farmer-managed irrigation organizations. pp. 331.
14. U.S. Agency for International Development (USAID). 1983. Irrigation and AID's experience: a consideration based on evaluation report, n.8, Washington, D.C.
15. Vermillion, D.L. 2000. Guide to monitoring and evaluation of irrigation management transfer. pp.71
16. Vermillion, D.L. and Sagardoy, J.A. 1999. Transfer of irrigation management services. FAO Irrigation and Drainage paper 58. FAO.Rome

IRRIGATION MANAGEMENT REFORMS IN IRAN: LESSONS LEARNED FROM 15 YEARS EXPERIENCE AND ISSUES FOR THE FUTURE

S.A.Heydarian[1]

ABSTRACT

Irrigation development in Iran has been started since 1961. From 1961 up to now, more than 1.5 million hectares modern irrigation networks have been constructed, but are not performed very well. From 1991 Irrigation Management Reforms (IMRs) have been initiated in Iran. It was evidenced; the results of IMRs would be obtained through long-term program and its process. The final results and sustainability of achieved outputs have more dependency on the level of active participation of local communities and governmental body in the process and their trusts to natural and inherent of participation. In this context the active participation in the process follows the assurance of the empowering and institutional capacity building for the construction of further Participation Irrigation Management (PIM). In fact, the new built capacities are the main sources for the principle evolutions and reforms. In this article, through rapid diagnosis (RD), IMRs' constraints have been reviewed and lesson learned obtained from 15 years experiences in Iran. RD indicates that abilities and technical skills of local communities have no priority as a pre-requirements of PIM, but PIM has a high dependency on awareness of the executive team to this approach and their skills to conducting participatory methodology, transparency of national policies and strategies for IMRs, plans for principals evolution on community attitude to new approach, their managing abilities, their trusts to local government, etc. Based on this experience, adaptation of IMT/PIM plan with farmers' perceptions is the key element of success and defined practical bylaws to conduct in actual situation as well. Execution of IMT/PIM in national level needs holistic plan for enhancing the institutional capacities (including: GOs, NGOs, private sectors and local communities) at all level and local managerial empowerments. In this case, empowered local authorities and communities can conduct the management of Irrigation networks, according to the national and local policies through reform process.

However, over the three categories of intensive efforts, a number of policy adjustments on modern Irrigation networks' management have been carried out in Iran. Such efforts are devolving the responsibility of irrigation management to users, but with inapplicable

1- Member of IRNCID executive board and Chairman of working group on PIM, as well as, senior researcher and scientific member of SCWMRI.

legislations for transferring the authorities. In addition, lack of methodology and clear IMT/PIM process to key staffs were main constraints on IMT/PIM process within the past 15 year's efforts. At the moment, critical points of IMT/PIM, as well as, the mid-term and long-term strategies are well known for further application. This paper describes the efforts, constraints, lessons learned and issues for the future.

Key words: Management reforms, strategies, IMT/ PIM, Iran.

INTRODUCTION

We have made about half a century efforts on solution of social and management constraints of Irrigation system through irrigation management transfer (IMT) and participatory irrigation management (PIM). Now it is clear to us that farmer participation on Irrigation operation and maintenance is a part of solution of weak performance of the irrigation systems in the world.

Recent researches focusing on reforms of institutions made clear to us that; there are more constraints, which have not had solution in short-term reforms. There fore, proper capacity building in local community and local government for irrigation management transfer requires a long-term plan.

Now the question is: how could be ensured about the sustainability of the reformed irrigation management through transferring the responsibility for O&M to the users, without transferring the sufficient authority and proper capacity building in local level? Of course, in this situation there is no guarantee to increase water efficiency and to improve system performance.

Today in Iran, the government face the challenges of optimizing allocation and utilization of the limited water resources for food production, and rural livelihoods. However, the lack of farmers' participation in the rural affairs was known as one of the reasons for the failure of the irrigation management improvement and development.

Transfer of irrigation management from the government to local level constituent (both in public and private sector) and forming irrigation participatory management, which are involved in organizing the operational and maintenance of irrigation network and administrative as well, needs a long term program which must be implemented through well defined plan and managed participatory monitoring and evaluation program. Irrigation management reforms, if not implemented well, can lead to further constraints rather than improving irrigation performance (Kendy, et. al. 2003). From 1960s, many practices have been done on participation as one of key element of irrigation improvement, but the paradigm of such an approach could not have been understood as well, and caused a failure to achieve intended result. The First model based on public participation in the 1980s and 1990s were developed (Burkey, 1993; Chambers, 1997; Khanal, 2003). This reform happened through local management by users' organizations, referred to water users association (Vermillion & Sagardoy, 1999; Meinzen-Dick et al., 2002). IMT is the full or partial transfer of responsibility and authority for the governance, management and financing of irrigation systems from the government to water users associations. At present, WUAs progressively take over responsibilities and the role of government & irrigation agencies. (Vermillion, 2003; Peter, 2004).

Irrigation development in Iran has been started since 1961, from 1961 up to now, more than 1.5 million hectares modern irrigation networks have been constructed in Iran, but are not yet performed very well. There fore, the system of irrigation networks could not fully provide acceptable water efficiency and productivity. Under three groups of intensive efforts, a number of policy adjustments on water resources have been performed. Further to this, Irrigation management reforms (IMRs) attempts have also been carried out on modern Irrigation networks of Iran.

In this context, various policies, law, regulation and bylaws were approved by the government of Iran through congress, aimed at improving efficiency of water use and its productivity. Such policies are devolving the responsibility of irrigation management to users, without clear legislations for transferring the authorities. In addition, lack of methodology and clear IMT/PIM process to key staffs were main constraints on IMT/PIM process in Iran.

This paper describes the past decade of Iranian experience on IMRs and the issues from these exercises, and also reviews the results of IMT/PIM on some pilots of Irrigation networks in Iran.

A SUMMERY OF TRADITIONAL MANAGEMENT REVOLUTIONS ON IRRIGATED AGRICULTURE IN IRAN

Iran is situated in the Middle East region of the South Western Asia and is located between 25^{o} and 40^{o} in the North, 44^{o} and 63^{o} in the East. The climatic conditions are arid and semi-arid, and about two-thirds of the country receives less than 250 mm of precipitation per year. It means that optimised use of water resources is very important in this country.

Regarding water management capacity, Iranian rural communities have a history of accumulated knowledge and experiences. Many years ago, there were no water resource management legislations, but non-written bylaws were accepted by the local communities. Hence, there were enough reasons for farmers to adapt themselves to such bylaws for proper management and efficient water use. In other words, there was no recurrent dilemma between the adaptations of farmers to the local bylaws and social context versus the implementation of the necessary managerial changes imposed by local elders or leaders.

In the other hand, under accepted definitions of local land attribution and water distribution, they had traditional water control and measurement structures. It should be noted here that, there was no considerable conflict or struggle in water distribution and Irrigation systems' maintenance. The farmers could manage their own traditional irrigation system even in water shortage during draught years.

The land reformation in 1962 changed the local social structures of water management and disturbed the traditional cooperation and social cohesion gradually. Governmental organizations and the relevant agencies (GOs) became the active external players in the economical and social life of the villages. Local community became passive in decision-making on main part of their daily activities. Therefore, the gradual weakening of traditional cooperation started in the rural area.

From that time, the government has developed dam construction and Irrigation networks as fast as possible. Development of water resources was an advantage but increased the financial burden on the government. Through this phenomenon, the gap between the authorities responsible for water resource management and the local communities were asked. Further to such planning and development revolutions in water resource management, which emphasized the “top-down” approach, the entire management on irrigation networks tackled to the government, with very limited involvement of the farmers.

Today the agricultural development could be seen in this country. Out of 37 million hectares of potential area for agriculture, 7.8 million hectares is under irrigation. For this command area, more than 85 billion cubic meters of available water is consumed (more than 70% of supplied water is used for irrigation). It means the efficiency of Irrigation water is not acceptable. This also is the other effect of that phenomenon.

In the other hand, from 17 billion cubic meters of available water of the large dam is consumed on the 1.57 million hectares. After 30 t0 40 years from the large dam construction, 0.7 million hectares irrigation networks (including the tertiary and minor units) were have been completed in the dams’ down-streamside.

The limited budget for construction, the conflicts between social perceptions and the designed schemes are the main constraints in these projects. Hence, continuous increasing financial burden lead to inabilities of government to fully provide the operation and maintenance costs and development as well. Moreover, inappropriate management of irrigation has contributed to environmental problems, operational and maintenance constraints caused the social problems and physical deterioration.

Within the past decade, the migration of rural population to the capital and urbanization has increased the domestic demand for water, which has put enormous pressure on the agriculture sector to reduce its consumption of water. Consequently the concept of participation became the most important pre-condition for the development plans. However, the farmers’ participation in irrigation management, were not possible, with having understood that the government should take the full authorities for developing and O&M of irrigation networks.

From two past decades (1990), Iran initiated the first 5 year plan for the economical, social and cultural development (5YDP). During the past decade Government also initiated the exercise of management reforms in the modern irrigation systems. This paper describes those management reforms’ exercises on Irrigation networks and water resource development as well.

IRRIGATION MANAGEMENT REFORMS IN IRAN

In early 1990, the first 5 year plan for the economical, social and cultural development (5YDP) is initiated. The general trend of the 5YDP was toward privatization. Irrigation networks development was a part of this plan, but more focused on budget sharing. According to 5YDP policy, farmers had to pay the majority of Irrigation networks’ construction costs.

Strategies of Irrigation Management reforms were not clear and the government was not succeeding in budget sharing policy for irrigation development. In addition, highly bureaucracies' constraints and inadequate maintenance of irrigation systems, led government to divert most of its roles to the private sector. In this context, three groups of events could be classified as follow:

1- PRIVATISATION ON OPERATION OF MODERN IRRIGATION SYSTEMS

In 1991, the government of Iran sought to provide more independence of operation and maintenance practices from public sector, in the management of the irrigation networks, and decided to establish a new private company - Operation and Maintenance (O&M) of Irrigation Networks Company (OMIC) - as an autonomous body under the Ministry of Energy (MOE). In this year a multilateral agreement signed by Jihad-Agriculture Ministry (JAM), Ministry of Energy, Management and Planning Organization (MPO). With the establishment of OMIC, the operation, maintenance and administration of the Irrigation network (INet) should have been transferred to local communities gradually. Each OMIC had concession of performing O&M in each INet.

The New Irrigation management policy enacted in 1991 rationalizes O&M responsibility, which is assigned to three administrative levels (Central / Province/local) with the designation of responsibility. OMIC establishment could be the origin to the Irrigation Management Transfer (IMT) program in Iran.

In early 1992, about 20 OMICs were established to perform following tasks:

- Improving the quality of Operation and Maintenance of Irrigation Networks;
- Increasing water use efficiency;
- Improving the efficiency of water fee collection;
- Reforming irrigation agency structure and reducing the number of employees;
- Improving the water users' structure, and promoting the Irrigation management systematically;
- Enhancing the collaboration and communication between water users and related public sectors;
- Developing the Participatory Irrigation Management.

At the beginning, the ownership of OMICs should be shared between water users (51%) and governmental organizations (49% for JAM & MOE). In reality, this kind of shared stocks was not applicable (e.g. deteriorated Irrigation network and reluctance of the farmers to tackle). Actually, 100% of ownership was shared between GOs.

Although in most of the INet, the quality of O&M and communications improved, government body became bigger and water users' management structures got weaker. In addition, most of the initial objectives were forgotten.

In fact, it could be said: there were acceptable incentives to transfer of responsibilities in the related GOs, but there were no sufficient incentives in local communities, unclear bylaws for transferring the needs' authorities to the water users, insufficient capacities in the local communities, improper structures to perform such responsibilities. Hence, according to this policy water users couldn't initiate and play their own real roles on

O&M and administrative affairs as well. Looking for solution on above-mentioned constraints made an extra force to the OMICs to perform the following policies.

2- SUPPORTIVE LAWS AND INTENSIVE POLICIES FOR OPTIMIZED USE OF AGRICULTURAL WATER

The backgrounds of these policies were as following:

- Based on note 19 from the second 5YDP (1995 to 1999), the government approved the related bylaws. This note emphasizes on Optimised Use of Agricultural Water (OUAW). In code 5 of this bylaw, the provincial part of JAM is responsible for establishment of water users' formal groups.
- Increasing the constraints of financial burden, limited employees, budget, insufficient equipments etc. in the Irrigation networks under OMICs management.
- Article 107 from the third 5YDP (2000 to 2004), and Article 17 from the fourth 5YDP (2005 to 2009) emphasize on participation of landowners and water users groups in soil and water resources management.
- Article 35 under chapter five from Agriculture and Natural resources Engineering Authority (ANEA) law (NGO).

Based on the above-mentioned supportive laws and intensive regulations, water users groups should be organized by the provincial parts of JAM with the participation of provincial parts of MOE and Ministry of Cooperation (MOC). In this regard, the Water Users Groups (WUG) as a formal type of Community Based Organization (CBO), but in the form of Cooperatives agency (WUC), presented in the Iranian water resource management literature for the first time in the 1996.

According to code 5 optimised use of agricultural water's law, the JAM should organize the WUG within the maximum two years and introduce the representative of each WUG to the OMIC for each intake of secondary canal, as the water-master who is responsible for water distribution among each tertiary unit water users.

In these intensive regulations and bylaws, main conflicts between two organizations (JAM & MOE) were as follows:

JAM had no formal department or section with defined budget for these kinds of responsibilities. In fact, such constraints were daily problems to MOE, but the responsibilities were on the other side (JAM). There were no defined communications or relations between JAM and WUGs in this regard. In reality, most of the agreements had no guarantee to be performed by JAM or other related GOs. There are many examples in this regard; the first exercise in Ghazvin Irrigation network, which has happened between 1997 and 2002, is a good example.

Qazain Irrigation Network (QINet), with 50,000 hectares area under cultivation, is located in the northwest of Tehran. Due to above-mentioned atmosphere (article five and constraints in OMIC management), the first IMT exercise is started by OMIC under high supervisory of MOE (at the capital) and on the basis of Consulting Engineering Plan (CEP) in 1997.

Although from the beginning of the Irrigation network operation, farmers had their own managerial structure to distribute water among one another, but for solution of some constraints on O&M, Irrigation management reforms should be performed. According to CEP, the secondary unit L2 selected as a pilot. 12 WUCs and one Federation were constituted within the two years efforts. These WUCs and its Federation have survived only for three years.

The results of Rapid Diagnosis (RD) on IMT in QINet, by Iranian PIM working group (IRPIM) in 2002, are as follows:

A) Main constraints

- Lack of clarity and unwell defined shared responsibilities to the majorities of the farmers;
- Transfer of responsibility to the WUCs with insufficient authorities;
- Financial Burden on WUCs with undefined budget sources;
- Insufficient capacity of WUCs to carry out such transferred responsibilities;
- Poor legality to carry out the responsibilities;
- Related local governments left the WUCs, just after establishment without any co-ordination among them;

Finally, the majority of water users, which have to play the main roles, had no sufficient incentives.

B) Lessons learned

- In transitional period of time, more expenses will result to the farmers to carry out the new responsibilities, looking for the solutions of such constraints should be paid before WUCs' constitution;
- After the WUCs were constituted, the local GOs (JAM&MOC) should pay continuous attentions to WUCs with respect to authorized them;
- WUCs should be supported (not as a charity, not as a subsidy, but as a real means of participatory) and strengthened for a transitional time segment, while it is necessary;
- IMT has its own defined process, which should be experienced.

In this regard, the local department of JAM was not interested in WUCs' constitution. Particularly, they had different model in their hands (Rural producers Cooperative = RPC) and trying the new model was not interested to them (e.g. Novin Dez RPC in Khozestan province, Mahidasht RPC in Tehran province).

In fact, such intensive regulations couldn't have any positive impact (except Lesson learned) and acceptable performance until 1999.

Due to suggestion of MOE, In order to find the solutions of above-mentioned constraints, the OUAW bylaw's committee at two levels (capital and provinces) was established in 1999. This committee includes the representatives of MOE, JAM and MOC.

The committee conducted several meetings and had several outputs. The first bylaw for instruction of WUCs was the most important one. This bylaw was approved by MOC and was ordered to Provinces to establish the WUCs as fast as possible.

According to this bylaw, many WUCs were established, but most of them never succeeded. The main constraints were lack of sufficient incentives, lack of defined position for WUCs on decision-making and WUCs' institutional weakness to play their roles.

In beside of WUCs, the RPC also couldn't find own institutional capacity to perform OUAW law and plays basic roles in 1990 decade. Gillan experience is a good example in this regard.

In early 2002, the OUAW bylaw's committee suggested to Gillan's OMIC transfers a part of O&M responsibilities (e.g. fee collection) to Rural Consumers Cooperatives (RCC) and RPC. Negative impacts were their performance within the five years.

In some Irrigation networks, establishment of the WUCs was not on their plans. Those OMICs choose the different strategy and performed the improved traditional management. Varamin Irrigation network experience was a good example in the late 1990, in this regard.

From the beginning of the Varamin Irrigation network (VINet) operation, farmers had their own management model. In this model, the representatives of WUGs in each secondary unit were responsible for operation and maintenance of lower part of main canals with developed cooperation. During the drought years and water shortage such cooperation enhanced. According to article five from OUAW's bylaw, such cooperation enhanced up to villages (includes several secondary units) and participation grew up faster. At the moment, Secondary units CW and CNZ covers 14 and 50 villages respectively and 300 representatives have been reduced to 150 representatives.

The results of Rapid Diagnosis (RD) on IMT in VINet, which has been done by Iranian PIM working group (IRPIM) in 2003, are as follows:

A) Main constraints

- Lack of legal recognition of WUGs by provincial and local government.

B) Lesson learned

- Adaptation of IMT plan with farmers' perceptions is the key element of success. In this case, it could be thought about farmers' financial supports to the IMT.
- In some irrigation networks, without any external force on WUC' constitution, capacity and power of the WUGs have been enhanced for the management

reforms. Those reforms were compatible to the administrative legislations and social conditions with less constraint.

However, in VINet, WUGs could delegate the responsibility for the O&M of secondary units to main canal, depending on their abilities and willingness to participate in each of them. Given the positive experience and clear benefits of good water management practices seen over the past years, the OMIC and the WUGs are prepared and ready for whatever the new legal arrangements will bring (e.g. WUCs), and hopefully the outcome will lead to a further improvements to the objectives of OUAW.

In addition, there are many examples in this regard, which have been related to Iranian civilization on water management. For example; from the beginning of operation of Mojen Irrigation network, the WUGs have equipped themselves for management of Irrigation network. It means, they had never thought about sharing responsibilities with external players. They developed their indigenous knowledge and improved their institutional capacities. In early 1960, they constituted the MOjen Agricultural and Irrigation Ltd to better management of Irrigation system. At the moment, they perform all related duty of O&M and administrative affairs as well, without any governmental support and intervention.

With regard to Article 107 from the third 5YDP (2000 to 2005), landowners and water users groups' participation on soil and water resources management became highlighted again. Preparing a bylaw for this article, the OUAW bylaw's committee conducted several meeting and the first draft of participatory plan was its output in 1992, but it wan't approved by MPO. However, with holding those meetings it had some more positive impact on decision- makers in MOE and JAM.

In addition, In the third 5YDP Article 35 under chapter five from Agriculture and Natural resources Engineering Authority (ANEA) law (NGO), more attention was paid on soci-economical formal structured farmers' business groups and marketing.

According to Article 35, JAM had a mission for maximum 6 months to provide the constitution of agricultural activities. In the introductory draft, WUA has a position at the core of all different agricultural constitutions. At the moment, this model for agricultural constitutions activities is under the test in Gazvin Irrigation Network.

As a summery of this chapter of efforts, it could be said that there were a lot of efforts on agricultural constitutions and valuable lessons learned came up from such efforts, but the strategies haven't been approved yet. Most of the articles in the third and the fourth 5YDP, not yet officially implemented since the required bylaws have not been prepared giving important constitutional discrepancies regarding agricultural water use and management. Additionally, a set of reforms on the National Water Law and natural resources are waiting for approval by Congress.

3- SUPPORTIVE LAWS FOR FINANCIAL SUPPORT (NATIONAL & INTERNATIONAL)

In the first 5YDP (1990-1994), budgets' sharing was one of the strict requirements for construction of irrigation networks. Funds for construction of tertiary units must be shared among farmers. However the policies were in transition and some costs were still being covered by government funds. Under those regulations, the primary financial responsibility for irrigation construction of the main and secondary canals and infrastructures for the scheme rests with the central government.

According to the first 5YDP, country's development should have increasing rate. There were not enough budgets for such development. Using financial supports was necessary and loan from internal and external banks was a part of the first 5YDP policies.

Although, when we talk about IMT, we refer to management of O&M and administrative in constructed systems under the GOs' management, so budgets' sharing for construction of irrigation networks has a different story. But this story has influences on IMT in IRAN. Supportive laws and Financial Supports are described at below:

- National supportive laws for irrigation development

Before the second 5YDP, there was an agreement between the government side and agricultural bank about special loan (credit) for soil and water development with low interest rate. Note 3 was one of the yearly budget's law for this purpose (e.g. using loan for traditional canal lining). These agreements have been improved from the second to the fourth 5YDP as following:

In note 26 from the yearly budget's law (1994-95), farmers were responsible to provide 75% budget of irrigation networks construction.

Note 76 from the second 5YDP (1995-99) with improved the government's share up to 30%. Article 106 from the third 5YDP (2000-2004) and article 17 from the fourth 5YDP (2005-2009) extended credit's facilities from the past decade.

Individual farmers have used these financial facilities from 1994. Beside of individual farmers, constitutional arrangement was required in some main and secondary canals. Three types of arrangements carried out in this regard are as the following:

- Under responsibility of Villages' Islamic Council (VIC) such required arrangements for collecting shared budget were approved (in most of the developed irrigation canal).
- New Short-term constitution, including Sar-Abbyaran (traditional canal operators) or/and communities' leader was established for such required arrangements (e.g. Karaj irrigation network).
- New permanent WUCs or RPC were established (e.g. Sufie-chai network). 17 WUCs have been established before 1995 in East-Azarbaiejan province.

Most of designed canal construction and objectives (the above three categories) were fulfilled, but with regard to development of PIM, some constraints could be recognised as follows:

- Lack of clear legal position for WUCs in decision- making on water resource management;
- Improper GOs' constitutions for administrative and technical support of WUCs;

- Lack of clear strategies for enhancing the WUCs' capacities and empowering.

The IRPIM surveys indicate that uncompleted process of PIM's development is the main causes for most of the constraints.

- International financial support for Irrigation improvement

Irrigation improvement project was a joint project between government of Iran and World Bank (WB). This project was on MOE Irrigation program in 1991, but one of the main conditions to gain the WB financial support was to understand about legal position of WUGs in the Irrigation systems. The project has been approved and started in four irrigation networks; (Moghan; (MINet), Behbahan; (BINet), Tajan; and Zarriene-rud), in 2000.

Improvement of MINet and BINet has been performed and Tajan is under construction.

The project performance was good in physical improvements (MINet and BINet), but not so good in Irrigation Management Improvement (IMI).

In Moghan, According to intensive study and field works, the secondary canal DC6 selected as a better condition for IMT pilot. In coordination of local government (MOE and JAM), more efforts performed and Pishro's WUC was constituted for IMT on 1000-hectare command area in late 2001. WUC received enough technical and financial support from local government sectors (JAM and MOE), but such supports never could sustain the Pishro's WUC.

The results of Rapid Diagnosis (RD) on IMT in MINet, which has been done by Iranian PIM working group (IRPIM) in 2003, are as follows:

A) Main constraints

- There was no incentive for IMT in both side (local governments and communities);
- In the local government and communities' points of view, the physical improvement objectives were well defined, but the IMT not;
- There was no agreement in order to indicate the shared responsibilities.

B) Lessons learned

In Moghan, the close coordination between local authorities, technical and financial supports to the WUC had a picture of the successful story, but this cooperation was not sustained for a long time. In the short time (a few months), the conflict between cooperative board and the members put an end on another IMT exercise. This exercise indicates; if there is not any common incentive between GOs and water users with regard to IMT, IMT will not be successful.

SUMMERY OF IRRIGATION MANAGEMENT REFORMS IN IRAN

A) Constraints

- Transfer of responsibility to the WUCs with insufficient authorities;
- Insufficient capacity of WUCs to carry out such transferred responsibilities;
- Unclearness and unwell defined shared responsibilities to the majorities of the farmers;
- Lack of defined common incentives between GOs and water users with regard to IMT;
- Lack of clear legal position for WUCs in decision- making on water resource management;
- Lack of practical bylaws, which could be conducted in actual situation.

B) Lesson learned

- In transitional time segment, more expenses will result to the farmers to carry out the new responsibilities, looking for the solutions of such constraints should be paid before WUCs' constitution;
- Adaptation of IMT plan with farmers' perceptions is the key element of success. In this case, it could be thought about farmers' financial supports to the IMT;
- IMT out of PIM and its whole process has no meaning in the reality. It means the WUCs' constitution is one of the tools for PIM, but is not PIM's objective;
- In IMT/PIM process, if there is not any defined common incentive between GOs and water users, IMT/PIM will not be successful.

C) Conclusion

- IMT is a part of water resource management reforms in Iran;
- Three parallel efforts have been conducted for IMT/ PIM in Iran and have more positive impacts on front line of decision-makers' attitude and have more lessons learned for future plan;
- Past decade experiences have a few positive impacts on local communities;
- There are four classified constituents in the PIM process (by author). These constituents are as follows:
    - Participatory Diagnosis;
    - Participatory planning and implementing;
    - Up scaling and out scaling;
    - Participatory Monitoring and evaluation.

Only a part of the second one has been taken into the considerations by the IMT/PIM executive teams in Iran.

- There are more institutional capacity for IMT in private sectors (OMICs & RPCs & RCCs), but need institutional revision;
- Now a days, decision-makers pay more attention to upgrade IMT/PIM in the GOs body and the private sectors;
- IRNCID has been the main scientific entity for IMT/PIM in Iran (through establishment of IRNPIM working group, publications, conferences, workshops, fieldworks reports, written and verbal communication, and meeting with front line of decision-makers, NGOs, CBOs and individual farmers etc.).

ISSUES FOR THE FUTURE

Execution of PIM in national level needs holistic plan for enhancing the institutional capacities (including: GOs, NGOs, private sectors and local communities) at all levels and local managerial empowerments. In this regards, we need more investments.

Carrying out the PIM process, as well as, combining the traditional and modern form of participatory management needs special knowledge and specific skills. Due to insufficient professional experts and lack of proper methodology adaptable to different social-physical characteristics of Irrigation networks, conducting any plan of PIM in Iran needs a mid-term program in some pilots. Let’s say 10 pilots for 10 different social- physical characteristics to test the methodology development.

Such mid-term pilots test could help us develop the methodology compatible to Iran conditions, out-scaling and up-scaling through participatory monitoring and evaluation (PME) for long-term plan.

With this suggestion, the opportunities will be provided for: Increasing the common incentives and trusts between stakeholders; enhancing required capacities; time left for learning by doings and training of trainers for long-term program; sufficient times for clear definition and designing the accepted plan of PIM (objectives, strategies, levels, how? where? Whom? etc.). Of course, in reality, awareness and continuous communication between different stakeholders (related GOs and local communities) could be enhanced through Participatory Monitoring and Evaluation in the short-term plan as well.

REFERENCES

1. Chambers, R. 1997. Putting the First Last, Whose Reality Counts? Intermediate Technology Publications: London.
2. Heydarian, S.A., F. Ebnali and M. Maschi, 2002. “Guide to Monitoring and Evaluation of Irrigation Management Transfer, IRNCID,No.56
3. Heydarian, S.A. 2003.”Assessment of Irrigation Management Transfer Using Fuzzy method", Iran Water Resources Management Organization (IWRMO), Applied research, final report, Ministry of Energy, Iran.

4. Heydarian, S.A. 2005. A guide for participatory management for conservation of Biodiversity, SGP/GEF, Iran.
5. Heydarian, S.A. 2005.”Developing a methodology for Participatory Irrigation Management, Water Resources Management Co. (WRMC), Applied research, final report, Ministry of Energy, Iran.
6. Heydarian, S.A.2006.Ten Steps for Participatory Management Development in soil and water resource management, SCWMRI, Iran.
7. Heydarian, S.A. 2006. ”Irrigation Management Transfer; Why and how? ", The Forth Workshop of participatory of water users in Irrigation networks management, IRNCID, NO.101.
8. Heydarian,S.A.2007. Irrigation management transfer (principals and methodology), IRNCID, Iran.
9. INPIM, (2005). Public Private Partnerships in Irrigation and Drainage، Eighth International seminar on participatory Irrigation management، Tarbes، France
10. Martin, L. van der Schans, Philippe Lemperiere, 2006. Participatory Rapid Diagnosis and Action plan, IPTRID, IWMI, FAO, Rome.
11. Moztazar, A.A, S.A.Heydarian, 2001. "The participatory Approach to the integrated watershed management", lst Asian regional conference, 17, 18 sep., ICID.
12. Nejad, A.N., A.saadodin and S.A.Heydarian, 1998. "Review of policies and strategies of watershed management in Iran", International symposium on comprehensive watershed management, 7-10 Sep, 1998, Beijing, china.
13. Svendsen, M. and Nott, G. 1998. Irrigation management transfer in Turkey: Process and outcomes. Advanced Short Course on: Capacity Building for Participatory Irrigation Management (PIM). Valenzano, BA (Italy) 7-23 September 1998.PIM-Case Studies, V.2.
14. Talebbeydokhti, N., A. Telvari, and S.A. Heydarian, 1999. “Regional workshop on Traditional Water Harvesting Systems”, Editors, May 1-5, 1999, Tehran, Iran.
15. Vermilion, D.L.1999, Transfer of Irrigation Management Services Guidelines، FAO Irrigation and drainage paper: 58،
16. World Bank، (1998). Guidebook on Participatory Irrigation Management، WWW.World Bank.org.

IRRIGATION AND POVERTY ALLEVIATION: PRO-POOR INTERVENTION STRATEGIES IN IRRIGATED AGRICULTURE IN ASIA

Intizar Hussain[1]

ABSTRACT

Irrigation is an essential part of the package of technologies, institutions and policies that underpins increased agricultural output in Asia. Past experience shows that this package, although broadly beneficial to societies, has not yet fully succeeded in banishing poverty. So in the context of UN millennium development goal of halving world poverty by the year 2015, are there ways of making the package more pro-poor in the future? In 2001-2002, the Author, at the International Water Management Institute (IWMI), in collaboration with national partners in Asia launched a major multi-country study that set out to answer this question. The study explored the links between irrigation and poverty alleviation in six Asian countries (India, Pakistan, Bangladesh, China, Vietnam and Indonesia, with the aim to determine realistic options for increasing returns to poor farmers in the low-productivity irrigated areas within the context of improving the overall performance and sustainability of the established irrigation systems. This unique mega study is based on primary data collected from over 5400 rural households covering 26 irrigation systems, supplemented with reliable secondary data and review of global topical literature on the subject. It develops a framework for pro-poor interventions in irrigated agriculture and offers a model for designing future pro-poor projects in irrigated agriculture. This paper provides a succinct summary of the synthesized results, conclusions and lessons learnt from this major multi-country study. The summary of the lessons, pro-poor options and the guidelines presented in this paper could be useful for the government policy makers and planners, donors, NGOs, researchers and other stakeholders involved in irrigation and rural poverty alleviation efforts in developing Asia and elsewhere.

Key words: irrigation; rural poverty alleviation; irrigated agriculture; pro-poor interventions; Bangladesh; China; India; Indonesia; Pakistan; Vietnam; Asia

1- Executive Director, International Network on Participatory Irrigation Management

INTRODUCTION

There is no doubt that the Green Revolution transformed the lives and livelihoods of millions of Asia's people. Between 1970 and 2000, annual cereal production in the region more than doubled to nearly 800 million tons, with most countries achieving self-sufficiency in staple food grains. The threat of famine, never far away during the 1960s, receded over a period when the region's human population increased by roughly 60 percent. Rural incomes rose, city food prices fell—and the economy prospered. But the rest is decidedly *not* history. Despite the achievements of the Green Revolution, poverty persists in Asia, which today contains the highest absolute numbers of poor—more poor people even than in sub-Saharan Africa. Poverty is particularly deeply entrenched in South Asia, which is home to 44 percent of the world's poor.

The Green Revolution in Asia could not have happened without massive flows of water—irrigation water—to bring the best out of the new crop varieties and other inputs that were also made available to farmers. Nor would it have been possible without massive flows of investment capital to build new irrigation schemes and expand existing ones as well as to fund the provision of other infrastructure and services to rural areas, including research and extension. Today, the use of both surface water and groundwater remains essential to Asian agriculture: 40 percent of the region's cropland is irrigated. Hundreds of millions of rural people across the continent depend on irrigation—including large and medium-scale canal systems—to earn a living from farming.

Irrigation, then, is an essential part of the package of technologies, institutions and policies that underpins increased agricultural output in Asia. Past experience shows that this package, although broadly beneficial to society, has not yet fully succeeded in banishing poverty. So, in the context of the UN millennium goal of halving world poverty by the year 2015, are there ways of making the package more pro-poor in the future?

In 2001, the author (formerly at the International Water Management Institute, Colombo) in collaboration with national partners, launched a major study that set out to answer this question. Funded by the Asian Development Bank (ADB), the project explored the links between irrigation and poverty alleviation in six Asian countries. The objective was to determine realistic options for increasing returns to poor farmers in the low-productivity irrigated areas within the context of improving the overall performance and sustainability of the established irrigation schemes. The study examined the evidence regarding the effects of irrigation—and particularly its interaction with other components of the package—as a basis for drawing out lessons for policymakers, donor agencies and researchers.

The six countries included in the study were deliberately selected to encompass different policy, social and economic settings. Three countries in rapidly growing but inequitable South Asia—India, Pakistan and Bangladesh—formed a contrast with two in East and Southeast Asia—China and Vietnam—where economic development has proceeded more fairly and with a third, Indonesia, in which irrigation development has been part of a large government-funded transmigration scheme. China, in particular, is a case in which irrigation and agriculture have developed in the context of a long-term national program to eradicate poverty. The six countries also present contrasting models of the transfer of irrigation management from public agencies to farmer groups or private hands.

The study, which is based on primary data and a review of global literature covering more than 200 studies, was the most thorough of its kind ever carried out. Over 5,400 households in 26 irrigation systems took part in surveys during 2001 and 2002. The 227 professionals who worked on the study interviewed a cross section of irrigation stakeholders, from farmers to local and national policymakers and practitioners. Fourteen workshops with over 800 participants were held to plan the research and discuss its findings. By virtue of its scope, its widely applicable results and the strength of its multidisciplinary approach, the study provides a model for the design of future pro-poor projects.

The paper provides a generic framework for understanding and designing pro-poor interventions in irrigated agriculture covering a wide range of issues including benefits and dis-benefits (adverse impacts or externality costs) of irrigation; irrigation-poverty linkages; factors influencing performance of irrigated systems and their poverty linkages; irrigation management reforms, irrigation service charging for improved cost recovery, irrigation application and resource conserving technologies—and their implications for the poor. From the study findings and conclusions, the following broad lessons are identified for the consideration of government policymakers, representatives of donor and development agencies, and others charged with reducing poverty in irrigated agriculture, (see Hussain 2005 for detail).

Irrigation reduces poverty across all study systems. One of the main conclusions of the study is that irrigation does indeed significantly reduce poverty as measured by household income. Poverty outside of irrigation systems in nearby nonirrigated settings is much higher (almost twice) than that within irrigation systems. However, poverty is still high in irrigation systems, averaging 34 percent. There are significant inter- and intra-country differences in poverty incidence in irrigation systems. Poverty is much higher in South Asian systems (particularly in Pakistani systems) than in Southeast Asian and Chinese systems. Inter-system differences in poverty are also much higher in the former than in the latter systems.

Indirect benefits of irrigation at the local and broader economy level can be much larger than the direct crop productivity benefits of irrigation. Canal irrigation generates a variety of direct and indirect benefits at the local and broader levels (increased crop productivity, employment, wages, household incomes and expenditures, increased food supplies/food security/food affordability due to lower prices, increased induced investments in agricultural and non-agricultural sectors, groundwater development and recharge), but the benefits vary greatly across settings. The indirect benefits of irrigation at the local and broader levels, including multiplier benefits, can be much larger than the direct local-level productivity benefits. Further, medium- and large-scale canal irrigation systems attract private-sector investments in irrigated agriculture, including in groundwater irrigation, and other related sectors. These benefits can help reduce poverty.

Irrigation reduces more poverty under certain conditions. The pro-poor impact of irrigation differs significantly from one setting to another. The extent of benefits to the poor depends on factors such as land and water distribution, the quality of irrigation and infrastructural management, the availability of inputs and support services, and water and agricultural policies. Irrigation can also be anti-poor in situations where adverse social, health and environmental dis-benefits/costs of irrigation outweigh the benefits the poor receive from irrigation. These anti-poor outcomes of irrigation reflect failure of policy, planning and management and can be avoided or minimized through effective interventions. Irrigation investments, whether in new development or in the improvement of existing systems, should not always be assumed to reduce poverty in a significant way. In fact, irrigation can be *strongly pro-poor, neutral or even anti-poor* depending on the above factors. In South Asia, several influencing factors, notably land equity and irrigation governance and management arrangements, have been unfavorable. So, despite large investments in infrastructure and related inputs and services, the poverty-related impacts of irrigation in that subregion has been mixed—and certainly not as good as in China and Vietnam. Overall, South Asia has only partially benefited, in terms of realizing poverty-reducing impacts of past irrigation investments, and there are significant opportunities for increasing benefits of irrigation to the poor.

Apart from irrigation, land, roads and education are important for poverty reduction. Evidence from our extensive review of recent studies suggests that no single intervention is sufficient for effective poverty alleviation. Irrigation is one of the important interventions for poverty alleviation along with land, education and roads infrastructure. Poverty-reducing impacts of irrigation are large when these and other complementary elements such as market systems are in place.

There is more poverty in some areas and among some social groups than in others. Despite the overall poverty-reducing nature of irrigation, income poverty persists in most irrigation systems, particularly in South Asia. Poverty levels are highest in marginal areas, downstream sites (the "tail"), and areas where canal water is in short supply and the quality of groundwater is poor. In South Asian systems studied, poverty is generally higher at downstream/tail reaches, particularly in areas where access to canal water is least, groundwater is of poor quality and alternative sources of livelihoods are more limited. In these systems, poverty is lower at the middle reaches than at the tail reaches. However, in Chinese and Vietnamese systems, head-tail differences in poverty are not as pronounced as in South Asian systems. In the latter systems, poverty tends to afflict the agriculture-dependent landless, female-headed households, as well as households whose farms have low productivity. Income poverty, which may be either chronic or seasonal, tends to be high in areas where irrigation systems perform poorly. These findings suggest that there is scope for targeting support to the poor in South Asian systems.

Equity and security in access and rights to resources matter for larger poverty impacts. Inequity and insecurity in access and rights to land and water are bad for both productivity and poverty. Where land and water equity exists, irrigation in itself is pro-poor (as in Chinese and Vietnamese systems).

As much as there is gender discrimination, there is also discrimination of minorities and groups along caste and ethnic lines in irrigation. There are strong linkages between irrigation, gender, diversity and poverty issues. In South Asian systems, poverty is generally higher among female-headed and low-caste/ethnic minority households. From a socioeconomic standpoint, they are important stakeholders. However, their participation in irrigation management is very low, and their involvement in irrigation decision making is important not only to address existing gender and diversity discrimination issues, but also to enhance benefits of irrigation investment to the poor men and women. The improved understanding of both gender and diversity issues is important for designing effective pro-poor interventions.

While irrigation management reforms of recent years in South Asia have generated some benefits, significant benefits to the poor are not visible. In South Asia, institutional reforms in the irrigation sector are moving at snail's pace and only on a limited scale (e.g., mostly at the tertiary "canal" level but not much at higher levels).

In many cases, these changes are proceeding without the prior elimination of basic constraints that have so far prevented poor people from fully enjoying the benefits of earlier irrigation investments. Irrigation governance reforms will help the poor only if they are carried out as part of a broader set of pro-poor changes— changes that address issues such as fair sharing of resources and higher agricultural productivity and profitability. There are indications, though, that the irrigation-sector reforms where implemented have improved infrastructural maintenance, made water distribution fairer, and boosted agricultural production and productivity. However, measurable significant benefits to the poor are not yet visible. The overall conclusion from the country studies is that while the ongoing reforms being promoted, particularly in South Asia, such as irrigation management transfer and participatory irrigation management, have generated some benefits including for the poor, they have been implemented only partially, with no explicit pro-poor elements, and are not sufficient for improving system performance and benefits to the poor in a significant way.

In South Asia, unless irrigation reforms are sharpened with a pro-poor focus, the poor may be bypassed. Irrigation reforms are likely to generate significant benefits for the poor where land and water are less inequitably distributed; users are socioeconomically less heterogeneous; benefits of irrigation to farmers are significant and irrigated agriculture is profitable; there are accountability mechanisms and incentives in place for improving service delivery; cost of irrigation to users is linked to service delivery; and irrigation performance is linked not only to broader-level growth benefits but also to benefits to the poor. In South Asian countries, where most of these conditions are only partially met, unless irrigation reforms are sharpened with a clear pro-poor focus through necessary changes in polices and institutions, the poor are likely to be bypassed, as in the past.

Some of the Key messages

- It is generally perceived that there is a trade-off between equity/poverty and productivity. This study suggests that this is not necessarily so. High level of inequities in land and water are bad both for productivity and poverty. Irrigation has larger poverty reducing impacts where land and water are more equitably distributed.
- Irrigation benefits are often seen mainly in terms of crop productivity improvements. However, the study suggests that crop productivity is only one of many irrigation direct and indirect benefits (such as benefits related to employment, wages, prices, consumption, food security, incomes, benefits from multiple uses of water, irrigation induced investments in agricultural and non-agricultural sectors, benefits from canal water induced groundwater development and recharge) classified as type 1-5 in this study. Indirect benefits of irrigation can be larger than direct benefits when these other benefits are also accounted for.
- It is often assumed that targeting of poverty and support to the poor in canal systems is difficult. The project findings suggest that poverty varies significantly across systems and locations within systems, particularly in South Asian systems, and geographical targeting of poverty across and within systems can be done.
- Low irrigation service charge policy is often justified on account of poverty and is assumed to benefit the poor. The study suggests that in settings with greater inequities in land and water distribution, as in India, Pakistan and Bangladesh, low level of irrigation charge does not necessarily benefits the poor, and it could be disadvantageous to the poor where low charges lead to under-spending on O&M works and the system performance suffers. Further, application of a single level of irrigation service charge across areas and systems could lead to situations where the poor end up subsidizing the non-poor.

The study suggests that:

- Irrigation interventions can be designed to re-distribute benefits in favor of the poor.
- For irrigation investments to be pro-poor, the criteria should be not only hectares developed/rehabilitated, but also the number of households/farms/persons benefited; and not only the aggregate productivity benefits but also the types of benefits and the share of the poor in total benefits.
- In making new investments (either in new development or improvements of existing systems) and in designing irrigation interventions and irrigation impact assessments/evaluations, it is important to incorporate a) poverty alleviation criteria as defined in this project (i.e. strongly pro-poor, pro-poor, neutral or anti-poor), b) generic typology of direct and indirect benefits and dis-benefits (type 1 to 5), c) typology of beneficiaries/affectees and d) a tri-level framework (micro, meso and macro levels) for identifying constraints and opportunities for enhancing benefits of investments/interventions to the poor.

In addition to offering a comprehensive framework for identifying and designing pro-poor interventions, the study provides a menu of pro-poor intervention options and a detailed set of specific actions and guidelines.

Effective institutions for management, incentives to managers and service providers, decentralized financing, and effective arrangements for monitoring and accountability matter for irrigation performance. Irrigation systems managed by public agencies tend to perform poorly. The underlying causes are inadequate funding, lack of incentives for good management, and weak monitoring and accountability mechanisms. Further, lack of clear and secure water rights and allocation rules and corruption-related problems adversely affect performance of irrigation systems and their poverty-reducing impacts. On the financial side, irrigation charges to users in South Asia are often too low or improperly structured, collection costs are too high, and the fees collected from users are not actually channeled back into local system operations and maintenance. Moreover, the low level of irrigation service charges applied uniformly to all socioeconomic groups of farmers often disadvantage the poor, particularly in systems characterized by high inequity in land and water distribution. There are indications, though, that performance is improving in irrigation systems where management functions have been transferred to local user groups and private service providers.

Benefits and costs to the poor, and long-term sustainability of irrigation software and hardware should matter in the calculus of irrigation investments. Irrigation investments have typically centered on the creation of physical facilities and institutions and on their economic performance in terms of aggregate costs and benefits, with little or no attention to specific benefits and costs to the poor. In most situations in South Asia, almost no attention has been paid to the longer-term sustainability of the new infrastructure and organizations created, and to enhancing their benefits to the poor on a long-term basis.

Larger poverty impacts can be realized by integrating investments in irrigation infrastructure, management and service delivery. Evidence from both other recent studies and ours shows that the poverty-reducing impacts of irrigation-related interventions are larger when they are implemented in an integrated framework [(e.g., integrated approaches for—managing surface water and groundwater; developing systems that allow multiple uses of irrigation water, and for new investments in improving irrigation infrastructure, irrigation management, and service provision in agriculture (provision of inputs, technologies, information, finance, marketing)].

Chinese experiences in resource distribution, institutional, management and technological interventions offer important learning opportunities for South Asia. As a whole, South Asia has much to learn from experiences in land and water distribution, institutional, management and technological interventions, in Southeast and East Asia, particularly China. In these latter regions, irrigation management and other support services are more incentive-based and relatively more equitable, and the agriculture productivity and the benefits of irrigation are higher as a result. China and Vietnam have adopted a "distribute first" approach to land and irrigation water, and rural development as a whole. South Asia, in contrast, has adopted a "grow first" policy in which distributional issues have largely been ignored. As a result, irrigation has not benefited the poor people nearly as much as it could have in this subregion. In the South Asian countries studied, there is a considerable scope for reducing poverty through land, water, productivity and related policy- and management-level interventions.

Based on these conclusions and lessons, the study develops a range of options, detailed specific measures and a set of guidelines for addressing the identified key issues and for moving forward with pro-poor interventions. In India, Pakistan and Bangladesh, the first and the basic step is to create an enabling environment for correcting existing resource inequities for poverty reduction—through development and strengthening of policies, laws and strategies (specifically related to poverty reduction, land, agriculture and the water sector) and linking these policies under a consistent framework. This should aim at creating permanent assets for the poor by developing and strengthening of land and water rights in a pro-poor mode (as proposed in this study). The following are some of the key suggestions for making irrigation investments in new development or improvement/ rehabilitation of existing systems pro-poor. Unless specified, these are applicable to all countries studied.

Make irrigation investments pro-poor

- select policy- and project-level interventions based on poverty impacts, including gender and diversity impacts, using a "pro-poor" criterion as suggested in the generic typology of interventions developed in this study (i.e., strongly pro-poor, pro-poor, neutral, anti-poor);
- make poverty impact assessments as the first step in designing, implementing, monitoring and evaluating projects and interventions;
- use the generic typology developed in this study to incorporate all forms of direct and indirect benefits and dis-benefits/costs of irrigation in policy and project development (see *Hussain 2005* for details on typology of irrigation benefits and dis-benefits);
- make irrigated agricultural investment packages for hardware and software development more comprehensive by integrating investments in infrastructure, management and service delivery in agriculture, with emphasis on integrated approaches and public-private partnerships;
- prioritize geographical areas and socioeconomic groups for irrigation investments and targeting support to the poor;
- recognize that both gender as well as diversity aspects are critical not only to addressing discrimination issues but also to enhancing benefits of irrigation investments especially to the poor.

Re-distribute irrigation benefits to the poor through policy and institutional reforms

- adopt a sequenced approach in irrigation reforms using a muti-level framework (micro-meso and macro levels) offered by the study, and prioritize geographical locations for reform interventions with separate models designed according to local conditions.
- in implementing irrigation institutional reforms, distinguish between *irrigation as a "resource" and as a "service"*—as the former concept requires some form of public-sector intervention in the management of a resource (as it has both positive and negative externalities associated with it), and the latter requires emphasis on

delivery of quality services. Adopt pro-poor approaches to managing resource and service delivery with pro-poor institutions, financing and service-delivery arrangements through participatory approaches as proposed in this study.

- for addressing difficult issues in land and water equity and rights in South Asian countries studied, start with modest measures (see Hussain, 2005 for details on proposed measures).
- promote other pro-poor measures that leads to redistribution of irrigation benefits to the poor:
    - promote differential irrigation service charging across systems and locations,
    - recover initial capital cost or replacement cost from advantaged areas and large farmers,
    - ensure compensation to the poor smallholders for failure of service providers to deliver water to them,
    - promote labor- intensive methods of construction and rehabilitation of irrigation for increased employment for the poor;
    - promote labor-intensive methods of production in new or rehabilitated systems,
    - involve the poor in irrigation O&M activities, monitoring and supervisory roles and in irrigation service charge assessment, collection and spending activities.

    Ongoing reforms provide an important entry point for promoting these proposed pro-poor measures, by incorporating them into the new irrigation/water policies and laws, guidelines to irrigation managers and service providers, and in new rules, regulations and laws being established for WUAs and higher canal-level organizations.
- promote decentralized financial autonomy of irrigation service, with an irrigation charging system designed to meet the dual objectives of improved cost recovery and increased benefits to the poor, with a strong regulatory backup. Introduce differential irrigation service charging across locations, and irrigation systems and relate them to system O&M costs, benefits derived from irrigation use and poverty situation—with due attention to aspects such as institutional arrangements, service charge level, charge structure, assessment, collection and spending. The study identifies twelve essential components of charging and offers options for designing a charging system to achieving the desired objectives (see Hussain 2005 for details).

Establish effective institutions for monitoring and enhancing benefits to the poor

- make new institutional arrangements for monitoring and enhancing benefits of irrigated agricultural investments to the poor by creating effective institutions - establish an independent organization/body for developing, implementing and monitoring pro-poor interventions in irrigated agriculture and for enhancing benefits to the poor men and women of investments in land and water-resources development especially in India, Pakistan and Bangladesh.

- promote pro-poor approaches to enhancing the value of water, including diversification of crop and farm enterprises for increased employment opportunities and higher returns to farming; and promote improved production methods, micro-irrigation, and resource conserving technologies.

Develop knowledge-base on poverty and promote learning alliances and partnerships

- strengthen the local-level knowledge base on poverty - the knowledge base on poverty at small geographical scales (such as the subdistrict or irrigation-system level) is weak and sometimes flawed. It needs to be strengthened. Donors, in partnership with national agencies and NGOs, could help create poverty maps and indicators for use at local scales.
- promote adaptive learning and action research. Support and facilitate cross-country exchanges of experiences, knowledge and learning, especially across China and South Asian countries.
- facilitate development of partnerships among public agencies, the private sector, NGOs and poor communities for improving access of the poor to resources and service delivery in agriculture.

We trust that the study lessons and the proposed pro-poor intervention options and guidelines offered in the paper would be useful to the government policymakers and planners, donors, NGOs, researchers and other stakeholders involved in poverty-alleviation efforts in developing Asia and elsewhere.

PERFORMANCE OF IRRIGATION AND PARTICIPATORY IRRIGATION MANAGEMENT: LESSONS FROM FAO'S IRRIGATION MODERNIZATION PROGRAM IN ASIA

Thierry Facon[1]

ABSTRACT

Recent efforts to improve irrigation performance in Asia have to a large extent concentrated on governance and institutional issues through participatory irrigation management and irrigation management transfer. Beyond the objective of improving financing of operation and maintenance of the systems thanks to farmers' contribution, these reforms were also expected to improve the efficiency and productivity of the systems. Participatory irrigation management, together with demand management, is often the main measure recommended in integrated water resources management plans to improve productivity and efficiency of irrigation.

A recent series of appraisals of large and medium-scale irrigation systems by FAO in Asia with a Rapid Appraisal Procedure suggests that participatory irrigation management has largely failed to deliver on all these major objectives. Water users associations created are weak and have little influence on major management decisions and water delivery while chaos – the difference between actual and stated management and operation – is not reduced. On-going efforts in a number of countries are essentially based on the same models and are likely to produce the same outcomes. These disappointing results have led reform promoters to advocate deeper reform on the ground that these disappointing results were due to incomplete reform.

This paper argues that, unless significant results are achieved in improvement of service delivery to farmers and water users associations and reduction of chaos, institutional reform will continue to have disappointing outcomes. This will require addressing not only the deficiencies of the participatory irrigation management models presently adopted, but also addressing other factors of poor performance, related to system operation, management and design, as documented by the results of the appraisals of the systems.

1- Senior Water Management Officer, Regional Office for Asia and the Pacific, Food and Agriculture Organization of the United Nations, 30 Phra Athit Road, Bangkok 10200, Thailand

The paper concludes by recommendations on key features of future reform, based not only on a review of present problems and issues but also on a forward-looking perspective of the future evolution of the irrigation systems.

IRRIGATION MODERNIZATION AND PERFORMANCE ASSESSMENT

In recent years, the Food and Agriculture Organization of the United Nations (FAO) has been promoting the modernization of irrigation systems in Asia with a focus on service oriented management. FAO defines modernization of the irrigation systems (FAO 1997) as "a process of technical and managerial upgrading (as opposed to mere rehabilitation) of irrigation schemes with the objective to improve resource utilization (labor, water, economics, environmental) and water delivery service to farms". This concept, centered on provision of water delivery service to farmers, has been the guiding principle for FAO's activities in the region and for the selection and development of performance appraisal tools and methodologies, such as the Rapid Appraisal Procedure (FAO, 1999) and MASSCOTE (FAO, 2007, forthcoming).

Recent performance assessments and reviews have revealed that past reforms and investments in the irrigation sector, focusing either on institutions or on infrastructure, have largely failed to produce desired results of improved water delivery service to the farmers. Performance assessment of a large number of irrigation projects (FAO, 1999) which underwent some modernization indicated that the lack of knowledge of proper options was the single most reason for mitigated success of irrigation modernization projects and modest improvements in the water delivery service to farmers after the implementation of these projects. A review of irrigation evolution in South and South East Asia (Barker and Molle, 2005) has attributed disappointing performance of institutional reforms (Irrigation Management Transfer (IMT); Participatory Irrigation Management (PIM) to their failure to improve water delivery service to farmers: design and operation constraints that are not addressed by these reforms significantly contribute to these results. An appraisal of initial conditions and performance of the systems to be transferred was thus estimated to be instrumental to allow both a better design and strategic planning of physical, operation, managerial and institutional improvements, to achieve specific service objectives to be provided both by the irrigation service provider to water users associations (WUAs) and by WUAs to their members (Facon, 2005).

FAO has therefore been calling for a massive re-training of engineers and managers in irrigation agencies, consulting firms and Irrigation Service Providers in Asia (FAO, 2002), in order to introduce and provide knowledge and ways and means to design, manage and operate irrigation systems economically for improved performance and adequate service to farmers as they aspire to improved socio-economic well-being, evolve toward more commercial forms of agriculture and face the challenges of globalization on the one hand, and water resources management moves towards integrated water resources management in the river basins and competition for water from other sectors intensifies on the other hand. FAO has developed training materials and detailed curricula, as well as specific tools for the appraisal of irrigation systems for benchmarking and the development of appropriate modernization plans for irrigation systems. The first training workshop under the program was organized in Thailand in

2000 and, since then Vietnam, the Philippines, Nepal, Thailand, Indonesia, Malaysia, Turkmenistan, Pakistan, India and China have benefited from support of the Regional Training Program. More than 500 engineers and managers have now been trained with support from the Program.

THE RAPID APPRAISAL PROCEDURE, THE TRAINING PROGRAM AND BENCHMARKING

The Rapid Appraisal Procedure (RAP) was originally developed by the Irrigation Training and Research Centre of California Polytechnic University in 1996-97 as a diagnostic and evaluation tool for a research program financed by the World Bank on the evaluation of impact on performance of irrigation systems of the introduction of modern control and management practices in irrigation (FAO, 1999). The conceptual framework of the RAP for the analysis of the performance of irrigation systems is the following: irrigation systems operate under a set of physical and institutional constraints and with a certain resource base. The systems are analyzed as a series of management levels, each level providing water delivery service through the system's internal management and control processes to the next lower level, from the bulk water supply to the main canals down to the individual farm or field. The service quality delivered at the interface between the management levels can be appraised in terms of its components (equity, flexibility, reliability) and accuracy of control and measurement, and depends on a number of factors related to hardware design and management. With the service quality delivered to the farm and under economic, agronomic constraints, system and farmers' management produces results (crops yields, irrigation intensity, water use efficiency), while symptoms of poor system performance and institutional constraints are manifested as social chaos (water thefts, vandalism), poor condition of infrastructure, poor cost recovery and weak water users associations.

In accordance with FAO's approach, trainees under the regional training program have been trained in modernization options, appraised their irrigation systems with the RAP and developed an irrigation modernization strategy for their system, with short, medium and long-term objectives and a phased action plan addressing both hardware and software improvements. Different aspects of management (incentives, training, budgetary resources and allocations, supervision, monitoring and evaluation, instructions to and initiative of staff, actual versus official practices, responsiveness of operation, gap between stated performance and actual performance, etc.) are rated. For Water Users Associations (WUAs), their overall strength is assessed based on the following criteria:

- Percentage of all project users who have a functional, formal unit that participates in water distribution;
- Actual ability of the strong Water User Associations to influence real-time water deliveries to WUA;
- Ability of the WUA to rely on effective outside help for enforcement of its rules;

- Legal basis for the WUAs;
- Financial strength of WUAs.

In addition, their in-kind and cash contributions to overall operation, maintenance, repairs and hardware improvements, is also assessed.

The details of performance indicators rating results and internal process indicators and sub-indicators, and values for the systems appraised under the training program, can be found in Appendixes 4 and 5 of this paper.

ACTUAL PERFORMANCE OF THE IRRIGATION SYSTEMS IN ASIA: SERVICE AND WATER USERS ASSOCIATIONS

All irrigation systems appraised at the occasion the regional training program were large-scale rice-based systems, with the exception, which will be the object of a specific paragraph. They were typically designed for supplementary irrigation of rice during the rainy season (with the exception of Turkmenistan, which is under an arid desert climate and the Jiamakou system in Shanxi Province, which irrigates orchards in a semi-arid climate). They are public managed in a supply-driven mode. Water users associations have been created in a number of countries but they do not play a meaningful role in the management of the systems. The systems are generally in a poor condition due to insufficient maintenance and provide poor service to farmers. Service provided by the main canals to the secondary canals and command areas is generally unreliable and inequitable, with the exception of Malaysia and Chinese systems. Water level control in the canals is poor and a main factor in poor service delivery. Some systems had not received support for many years while for others, substantial investment had recently been completed or was under way.

Design standards and operation have not changed in many countries for 20-30 years (Plusquellec, 2002). Specific flow-rates of the canals are calculated for supplemental irrigation, are therefore quite small, and decrease from the main canals to the lower level canals. This does not allow flexibility of operations and large variations in flow-rates. It is a particular constraint when farmers wish to synchronize their farming activities fro mechanization and thus need large amounts of water for land preparation at the same time, Cross-regulators are, with a few exceptions, manually operated underflow structures, in combination with underflow off-takes, and generally very sensitive to fluctuations in water supply. In the Philippines, duckbill weirs have been introduced for water level control. However, most of them have been vandalized as the systems have large variations in their water supply. During shortage periods, the upstream offtakes receive their allocation until available flows are depleted and downstream offtakes are shorted. In some cases, offtakes are of the overflow type (Rominj gates in Indonesia), which exacerbates fluctuations of flow-rates into the minor canals. Gates are rarely calibrated. The most common measurement method for flow-rates is the orifice formula through (non-calibrated) gates. Other measurement devices have been introduced (broad-crested weirs), but they are typically poorly designed (too broad) and inaccurate, or submerged. Recirculation of drainage is practiced in a large number of schemes, but none is equipped with buffer or regulating reservoirs.

Operation generally follows a seasonal schedule which is adjusted on average every week, usually following qualitative assessments of demand by managers or requests by farmers. Main structures are operated typically three times a day according to a set schedule, very often following instructions from a central office on gate positions. Although system managers often issue instructions on flow-rate targets at each off-take, these are rarely followed and most field operators adjust gates based on water levels in the canals. Farmers often operate the gates themselves and operators and managers have capitulated to this situation. A typical response to this lack of discipline is the "rotational supply": water levels are raised in canal reaches during "on rotation" periods and lowered during "off rotation" periods. Near-farm, and on-farm infrastructure is under-developed. The introduction of command area development on the structured design concept or proportional flow division as an alternative to previous fully-gated distribution network designs has not been successful. The systems are immediately subverted by the farmers.

Low-cost pumping technology and energy subsidies have allowed farmers to free themselves from the constraints of poor canal system performance or inadequate scheduling through groundwater pumping, illegal pumping from the canals, water scavenging or subversion of system policies and obtain more reliable or frequent supply, switch to other crops and more effective on-farm water management strategies and techniques. Conjunctive use is not managed by anyone but usually allows farmers to adopt highly productive farming systems.

General management policies are typical of public institutions in the region, with few effective systems for rewarding or sanctioning performance. Field-level operators are often very poorly paid and it is difficult for management and engineers to control how they actually operate the structures, which often differs form official rules and policies. How structures are actually managed is often directly responsible for instability of the system. In the Sunsari Morang (Nepal) system, main canal operators, when trying to provide a target flow-rate into a secondary canal, make an initial setting at the off-take of the secondary canal, then operate the cross-regulator of the main canal to lower or raise the water level in the main canal to adjust the flow-rate into the secondary canal. If they have raised the water level in the main canal too much, they then open a safety structure to divert the "excess" water supply into a drain. This example, while extreme, illustrates the important of all details of canal operation and of instructions to operators.

The administrative setup of the operating agency frequently hinders effective operation. In Thailand, the responsibility for operation of longs canal is divided into reaches under the control of different operation and maintenance projects which follow district boundaries. While water allocation is officially to each secondary canal, in practice there is a flow-rate target at the interface between each project. As a result, the projects focus their energy on disputes on flow-rates at these interfaces, operate the cross-regulators as flow control structures which creates water level fluctuations in the main canals, neglect flow-rate targets into the secondary canals, which thus fluctuate wildly, and no specific office is responsible in case of water deficit in the lower reaches of the main canals. While project managers already frequently integrate into their operation plans water supply to other users (municipalities, industrial customers), none of the projects appraised has specific environmental targets or goals.

Proposals and ideas of the training workshop trainees for improvement of their systems (and project proposals prepared by local consulting firms) - prior to the training - usually follow a standard menu of rehabilitation following prevailing standard designs, transfer of operation and maintenance costs to farmers, and substantial investments in rigid canal lining. The introduction of SCADA systems and information technology is frequently considered or already at an early stage of introduction. However, details of selection of sensors, of control logic, are frequently inadequate.

System managers rarely have in place effective monitoring and evaluation systems. When these are in place, they are rarely used for immediate feedback for operation. Flow-rates at spills and in drains are not monitored and managers do not have a proper water balance and estimation of the system's efficiency (with the exception of Malaysia thanks to IPTRID's national benchmarking program). There is however a gradual shift to performance-oriented management and the definition of performance indicators (Thailand). However, norms and budget allocations are often uniform nationally, not reflecting the constraints and potentials of projects, which may vary significantly across projects (Philippines). Some projects (Philippines) are piloting demand management with the introduction of volumetric water pricing. However, investment in the upgrading of the systems has not been geared towards improving control to customer water users associations, and proposed volumetric rates, based on current service fees, are not likely to yield expected water efficiency gains (de Fraiture and Perry, 2002, FAO 2004).

In summary, the level of chaos (difference between stated policies and actual policies) and of anarchy (subversion of policies) varies from system to system, but is generally high, particularly at the lower levels of management. Recent investments following standard standards or investment strategies (command area development) have poor results in terms of performance, control and service. While lack of discipline and institutional issues contribute greatly to this situation, many of the problems can be traced to:

- Problems in initial design;
- Exporting of design concepts outside of their area of validity;
- Difficulty to control and operate the systems;
- Layouts with confused hierarchies;
- Serious flaws in operation strategies;
- Inconsistencies between operating rules at various levels;
- Inconsistencies between operating rules and farmers' requirements;
- Changes in farmers' requirements not reflected by changes in system policies;
- Poor quality of water delivery service to farms;
- Lack of flexibility at all levels.

In this respect, irrigation planners, understood as central agency staff in planning and design branches, and irrigation managers, understood as system-level field staff in charge of system operation, are two different groups. The former are not necessarily aware of the specific difficulties which managers face every day. Planning and design procedures, as well as terms of reference for consulting firms which are frequently assigned the tasks of planning and designing system improvements, are typically not centered on the concerns of managers and farmers. Participatory design procedures are progressively being introduced, but they frequently focus on details such as layout of the canal networks or positions of the off-takes, rather than on more general (and more important) issues of service and performance objectives and design criteria.

A CHINESE EXCEPTION?

The RAP results of the Chinese projects (Zhanghe in Hubei and Jiamakou in Shanxi) stand in sharp contrast with projects in other countries. System efficiency, water productivity and service are very high compared with systems in Southeast Asia. While Zhanghe is essentially a rice-based system, it differs from other appraised system by its "Melon-on-the Vine" design, characterized by a large number of buffer reservoirs, at all levels, connected to the system. Jiamakou is a pumping scheme form the Yellow River in an arid province, has been converted rapidly from a wheat system to a commercial system dedicated to apple orchard, with a major challenge related to silt load in water supply. Both systems have benefited from modernization in recent years, and are currently not operated under upstream control. Cross-regulators are not used for maintaining constant water levels in canals. However, what distinguishes these systems from their counterparts is not so much technical features (infrastructure is not essentially better than the other projects') as management. The systems provide water delivery on an arranged volumetric basis to the heads of water user associations' canals, and charge water on a volumetric basis to farmers.

An additional feature of the Jiamakou management is the model of "business units" introduced for management: pumping, main canal water delivery and lower level distribution are organized into "business units" with performance targets which practically translate into financial incentives to staff. Before the RAP (May 2006), these financial incentives were related to efficiency of conveyance and distribution. As an outcome of the RAP, management objectives have been revised to include service standards, which have been translated into financial incentives.

For both projects, the authority of managers to effect and implement change seems to be much higher than in higher countries. This can be illustrated by the fact that, in Jiamakou, action was immediately taken: in the 4 months following the RAP, the Jiamakou manager organized additional training, working groups to analyzed RAP results and come up with recommendations, in the areas where service indicators had been shown to be lower than expected, has revised, as explained above, his management objectives and incentive systems, and implemented a program to improve water measurement devices at the head of field ditches, where water is measured for volumetric charging. Management objectives related to service improvement (improving lower level service in Zhanghe and improving field-level flexibility for Jiamakou) will imply using cross-regulators to maintain constant water levels, with the objectives of improving flow rate control at all levels of the systems. Technically and for management, the main issue for Zhanghe is to re-establish coordination among the multiple level reservoirs, which was disrupted by decentralization of water management, while for Zhanghe, the main issue is to utilize in-line storage to buffer the gaps between water supply by pump sets and demand, whose variations will increase with enhanced flexibility, as heavy silt loads do not allow for off-line buffer storage. For both systems, reducing service costs is a paramount objective. While Jiamakou sees financial incentives to staff as a key plank for improving performance, the one variable management cannot easily control is number of staff: the strategy is there to redeploy this staff over a larger service area in a future expansion phase.

WATER DELIVERY SERVICE AND WATER USERS ASSOCIATIONS

Actual water delivery service[1], which is evaluated based on flexibility, reliability, equity and measurement of volumes, in most irrigation systems is poor (17 systems below 2) to very poor (10 systems ranked below 1.5). Only 5 systems escapes from that bleak perspective: the 3 systems in Malaysia ranked medium (between 2 and 2.5). One system appraised in Vietnam and one in China achieved fairly good rates above 2.5.

The Institutional Reform in different countries is at different stages: WUA in some countries like Philippines and Cambodia at the time of evaluations were as old as 35, whereas in some other countries like Pakistan and China, they have been created only 2 to 3 years ago. In Vietnam and Cambodia, Water Users Associations or cooperatives are under the local governments. In Andhra Pradesh, they were officially defunct after 6 years of existence. A distinctive feature is that they employ irrigation teams (in Vietnam) or contractors (in Jiamakou, China, who also distribute water to the fields, collect water fees and receive a financial incentive based on fee collection) which distribute water to the field. In Thailand, the Philippines and Nepal, the WUAs are federated (with up to five levels in the case of Sunsari Morang, Nepal)

In general, water users associations in most of the irrigation systems are weak and have a little say in the way system is managed, even when they have been there for long time, for example in Philippines and Cambodia. The strength of WUA does not influence water delivery service to the farmers: no correlation could be found between the strength of WUAs and service to farmers ratings. The only exception to this is Jiamakou irrigation system in China which ranks high on water delivery service to the farm, water delivery service to WUAs, and strength of WUAs. This means that there are more important factors influencing the services to users, on top of it probably management at upper level. This translates into quality of water delivery service to the WUAs.

WUAs in almost all the irrigation systems have negligible budgets with most of its members contributing in kind. Irrigation service fee collection rate is often high (in the range of 70 to 100%) in the systems with strong water users association. However, even in those cases, overall financial requirements for system operation and maintenance are not covered, and the WUAs do not have the capacity to invest in system improvements. However, at the same time, in systems where pumping by farmers is ubiquitous (and paid by the farmers), corresponding expenditure can be very significant compared with

1- Ratings range from 0 (worse) to 4 (best) overall O&M spending on the surface system or much higher than surface delivery water fees.

While most of the WUAs have some kind of legal status, none of them apart from China and Vietnam can effectively rely on outside help for enforcement of their rules.

One of the limiting factors for some WUA in performing well is their small size and complicated hierarchical layers (sometimes as much as 5 layers of different Water users groups), which makes it difficult to raise enough funds or hire a technician for operation of the system under their control.. Farmers operate the gates without any knowledge of or consideration for hydraulic requirements and behavior of the system.

Some interesting and intriguing important conclusions of the study as shown in figure 3 are that:

- The performance in actual delivery service to users is independent of the strength of WUAs. This leads us to suggest that the real causes of the generally poor service in large irrigation systems are not addressed in most IMT-PIM reforms. FAO is convinced that too little attention has been paid to engineering, to strengthening the management set-up by ensuring professionalism at all levels of the management and these missing aspects should be the core of a badly needed "second breath" for IMT-PIM.

- The participation of Water Users Associations in management has not led in many cases to management objectives and policies that reflect the reality of water management in the systems: where farmers need to pump from canals or groundwater or recycle drainage water, these basic facts of the system are still ignored. Likewise, the actual cropping patterns, schedules and even crops in some cases, which are very different from what they were when the system was designed and built, are not reflected in official cropping patterns and scheduling.

- Responsiveness of management to service requirements and a basic agreement between managers and users on how water is managed in the system for what objective is still largely lacking. This includes taking into account the multiple uses and roles of water in the irrigation systems. In a sense, it seems that the reforms, which take a long time to deploy, seem to be geared to address to a large extent yesterday's problems (lack of funding for operation and maintenance and establishing basic equity, large fail to achieve those objectives and, if and when they eventually achieve then, they will be insufficient to meet the new requirements of farmers.
- A blueprint or standardized institutional reform package seems to have migrated from country to country, covering a large number of countries, particularly in Southeast Asia but also South Asia, with little adaptation to local circumstances and goals, and with essentially the same results. An interesting implication of the successive federation of WUAs from the bottom up is that the participation of farmers in important decisions takes place only once system-level federation and co-management are achieved (if that stage is ever reached). Participation,

including for new projects, should start at the early stages so as to influence system objectives.

CHALLENGE AND RESPONSE OPTIONS

In spite of or indeed because of these problems and disappointing results, the need for institutional and management reform is more pressing than ever. At the First South East Asia Water Forum, convened by the Global Water Partnership Southeast Asia (Chiang Mai, 2003), the *water and food session* of the Forum addressed the three challenges cited in the Kyoto Ministerial Recommendation of the 3rd World Water Forum on Water and Food, i.e., food security and poverty alleviation, sustainable water use, and knowledge and partnerships. One of the conclusions of the Forum, endorsed in the Forum's declaration, was that '*Southeast Asian countries should collaborate to find ways to improve and transform large rice irrigation systems for participatory decentralized management, improvement of efficiency and service, multiple use, financial sustainability through payment of service and IWRM*'.

This statement acknowledges the need for a transformation of the irrigation systems and participatory decentralized management in the context of achieving specific performance objectives in a broader context of water sector reform for integrated water resources management. Transformation is seen as a response to transformations in the agricultural sector and the broader socio-economic environment. In view of the conclusions drawn from the assessment of present performance of the systems and IMT/PIM, ways to improve and transform the systems should be designed taking into account the diversity of the systems and of their socio-economic contexts, probable and desirable evolution scenarios: IMT/PIM should not be considered in isolation as in the past but be an integral component of a broader transformation or modernization of the sector, be designed to achieve specific performance and service objectives and respond to farmers' needs not only now but also in the future.

With this in mind, FAO, with the support the Evaluation Study of Paddy Irrigation under Monsoon Regime (ESPIM) Project Financed by the Government of Japan and the Vietnam Institute for Water Resources Research, Ministry of Agriculture and Rural Development, Vietnam, convened a Regional Workshop on the Future Of Large Rice-Based Irrigation Systems in Southeast Asia in Ho Chi Minh City in October 2005 to identify strategies, opportunities and interventions for the sustainable management of large rice-based irrigation systems in Southeast Asia (SEA) over the coming decades in the context of improved management of water resources, and to promote collaboration in the region. The workshop intended to address three critical questions that would determine the character that large rice-based irrigation systems evolve over the next 20-25 years, namely:

- **How would agriculture and rice production evolve in SE Asia?** How would agriculture evolve to provide viable employment for the expected reductions in the agricultural labor force, in light of current population projections and predicted demographic changes; changing nutritional and dietary expectations; changing irrigated and rain-fed agricultural areas and yields; and increasing competition from the Urban, Industrial and Environmental water sectors? What changes would be required in agricultural water services to support the projected evolution of the sector?

- **What changes would required in irrigation service provision by the large rice-based irrigation systems?** What institutional, managerial as well as technological changes would be required for the large-scale irrigation systems to be able to provide the new range of services required by users and perform their new functions?

- **How would on-going and expected reforms and investment programs measure up against the projected needs of the region?** How should public sector irrigation agencies develop to support new agricultural demands; what might be the role of the private sector in future development? How could participatory management become effective? Could institutions recently or in the process of being created evolve towards becoming managers of multiple use systems if needed? Were there alternate approaches to irrigation and agricultural water management reforms that may be more effective and responsive to the sector's requirements? Were present models for management of large rice-based irrigation systems able to evolve towards future requirements? Were investments programs on large rice-based irrigation systems of the current generation responding adequately to the future challenges? Did current models for river basin management represent an optimal context for an evolution of the large rice-based irrigation systems towards sustainable management?

The workshop gathered fifty experts and representatives from: national irrigation agencies and institutions, river basin and water resources management agencies and national water apex bodies, agriculture ministries and environmental agencies as well as academic and nongovernmental organizations from countries in the region: Vietnam, Malaysia, Thailand, Philippines, Laos, Cambodia, Indonesia, Myanmar and China; regional bodies and institutions such as the Mekong River Commission, the Asian Institute of Technology (AIT); international organizations such as the Food and Agriculture Organization of the United Nations (FAO), the International Water Management Institute (IWMI), and the International Rice Research Institute (IRRI); the donor community, with the World Bank and the Asian Development Bank; internationally recognized centers of excellence such as the California Polytechnic State University; international initiatives such as the Comprehensive Assessment of Water Management for Agriculture; environmental INGOs such as the International Union for the Conservation of Nature and Wetlands International and the World Wildlife Fund.

The workshop reviewed trends and challenges related to water resources management, socio-economic development, trade, agriculture and rice production and the environment, the present performance of large-scale rice-based irrigation systems in Southeast Asia, national current and planned strategies, programs and goals for large rice-based irrigation systems, the rate of adoption and effectiveness of previous recommendations, and identified the main drivers of change. The workshop then outlined main scenarios for the future evolution of large rice-based irrigation systems, based on a typology of their characteristics and socio-economic environments, identified the implications of these scenario in terms of service and performance objectives, design, management, operation, institutions, financing, environment and biodiversity, and multiple use, re-appraised present policies, strategies, programs and intervention models, and made recommendations for new strategies and directions and concrete action. The typology adapted for the large rice-based systems, the drivers which influence their future and the evolution scenarios that were derived for the different classes of systems are presented in Appendixes 1, 2 and 3.

Having agreed on the evolution scenarios, the workshop split into 4 thematic working groups, to work on the specific implications of the drivers, strategies and policies, and evolution scenarios in four different domains and derive recommendations, considering also a review of previous recommendations, their effectiveness and implementation: Financing and multiple roles; Design and operation; Management and institutions; New irrigation systems.

The workshop followed an iterative process whereby the thematic groups reported and were able to comment on the work of the other groups, in order to ensure consistency and cross-fertilization of recommendations in all 4 domains. The final recommendations were finally presented and amended in plenary and adopted by the whole workshop. The recommendations are presented below.

FINANCING AND MULTIPLE ROLES

1. Modernization should aim to secure reliable, equitable and predictable water supply and be responsive to individual needs of farmers where possible. Trust farmers to respond to such a water supply, e.g., through conjunctive water use.

2. Water-delivery systems need to be flexible (technically, institutionally) to deliver water to multiple uses (agriculture, environment, city, industry, energy generation), from entire river basins down to (within) large irrigation systems.

3. Financing (capital and O&M) of irrigation systems needs to progressively move from subsidies to market-based incentives, and public-private cost-sharing mechanisms, as economies evolve (Early -> Transition -> Post-agriculture).

4. "Early economies" should anticipate for, "transition economies" should plan for, and "post-agriculture economies" should harmonize (social, cultural, institutional, and policy) water management for different ecosystem services within irrigation area and catchment.

MANAGEMENT AND INSTITUTIONS

1. SEA governments should invest in professionalization of irrigation management through the establishment of continuous in-service training focused on operational management:

   a- Training of today's graduates who are tomorrow's managers b- Training at all professional levels within irrigation systems across all relevant disciplines.

c- Overseas secondment of irrigation managers within the region and in higher-income countries.

d- Practical trainings for farmer organisations/WUAs/Federations.

2. The irrigation sector in SEA should operationalise and mandate a suite of assessment and performance measures to continually upgrade and compare the effectiveness of service provision and the management of negative externalities, such as environmental impacts:

a- RAP

b- Benchmarking

c- Introduction of service related performance for irrigation service provider staff.

d- Public accountability – balance sheets

e- Improve and sustain monitoring, data collection and processing and management for improved service provision.

3. Existing PIM approaches in the regions should be diagnosed, and successful approaches and their contexts identified and replicated. A key focus of initiatives to implement participatory management and management transfer should be on:

a. Minimizing the transaction costs relative to actual benefits of participation

b. Incentivizing participation and compliance of the irrigation service providers:

c. Self-financing arrangements

d. Functional water user associations and federations, with clear rights responsibilities and programs of action in both management and local investment.

e. To be effective, the service delivery of WUAs and Federations must be improved and support is required to realize this.

4. Propagandize! Take these messages to the governments.

DESIGN AND OPERATION

1. A greater awareness of the operational deficiencies of large rice based irrigation systems exists since the last FAO consultation; given the present lack of expertise and magnitude of the problem, there is a need to develop excellent "Water Control

Engineering" programs in universities and engineering schools. Related to this is the establishment of national/regional Centers of Excellence for irrigation modernization.

2. Regional training programs on Modernization and the Rapid Appraisal Process (RAP) specialized for different levels of the organization: senior managers, operations staff, designers/engineers. RAPs should be carried out before any new investment is put in place for a comprehensive diagnosis of the system, developing proper water management strategies, and benchmarking of existing and desired performance.

3. Revise national design standards and operation manuals to take advantage of new knowledge in the irrigation sector and state-of-the-art technologies.

4. Replicable pilot projects to demonstrate modern technologies; learn from practical experience for a relative small cost.

5. Consider use of new donor lending instruments – e.g., adjustable program loan (APL) (longer time periods are needed to design and implement modernization programs; typical 5 year loans are too short).

NEW LARGE-SCALE IRRIGATION PROJECTS

1. Comprehensive options and feasibility assessment. Before committing to new, large-scale irrigation developments a comprehensive assessment should be made of the land and water existing use values and development options in that place. If a new, large-scale irrigation development is proposed, it should be examined by a wide-ranging analysis which is ecologically, physically, politically, socially and culturally "logical". These different logics should all be used to guide analysis and debate when examining the feasibility of a project. This should take place before progressing into the formal, legal, often rigid and relatively narrow "impact assessment" process.

2. Vision of future changes. If a new, large-scale irrigation development is proposed, the design must recognize and be flexible enough to take account of the inevitability of future demand changes. As economies improve and alter, land/water use and cropping systems will change. Therefore the function/service of the irrigation will change. From the initial stage of the development of an irrigation project, it is important to visualise the trajectory of how these changes might occur (eg. from rice-focused production to more diversified enterprises).

3. Governance, water rights and responsibilities. Large-scale irrigation projects, as with any others, should be planned, built and operated within a governance regime that embodies social justice ethics, is transparent, and participatory. Participation in irrigation governance should not be restricted to technical experts and bureaucrats, but should be open to representatives of affected communities and interest groups. The water rights and responsibilities of all stakeholders should be openly negotiated and established, with equity and sustainability being primary considerations. Management arrangements for a new project should include, from

the beginning, credible representatives of different stakeholder groups.

4. Local capacity development. If a new, large-scale irrigation development is proposed, it is essential to increase efforts to boost the capacity of local stakeholders playing many different roles. For example, local decision makers need to be aware of the different options and feasibilities. Public authorities need to be skilled in designing terms of reference and oversighting contracts. Local consulting firms and engineers are required to construct and then be locally available to support ongoing operation, maintenance and adjustment. User groups need to be aided to improve water use efficiency. Local civil society organizations and universities should be able to play roles in governance (eg. monitoring compliance with negotiated protocols) and problem-solving. Supporting the development of this capacity needs to be factored into any new project.

5. Finance. In addition to the overall economic assessment, it is critical that an adequate financial strategy is put in place. The finance for complete construction must be ensured. Beyond construction, there must be a plausible strategy to ensure the availability of funds to meet full operation and maintenance costs, drawn from all project beneficiaries.
6. Monitoring impact on ecosystem and livelihoods. Irrigation projects do more than supply water. They become part of the ecosystem and may have major impacts, for example on groundwater hydrology. The year-round effect of a project on the hydrology and wider environment have to be assessed. As does the impact, whether positive or negative, on the livelihood of all affected peoples.

CONCLUSION

The findings and recommendations of the workshop have highlighted a number of key issues:

- Although a greater awareness exists of the present deficiencies of the irrigation systems, knowledge does exist, efforts to develop tools have been substantial and effective, and efforts t develop capacities have been effective where implemented, very little successful modernization has taken place in Southeast Asia.

- In the present context and under future perspectives, modernization of the irrigation systems and their management to increase their flexibility and insert them in river basin management, taking into account multiple functions of agricultural water management, is more required than ever. A fast pace of change is the one certainty, the other certainty being that unless management adapts, the discrepancy between stated an actual policies will widen.

- Compared with 10 years ago, new layers of complexity have been added to our understanding of irrigation, from multiple use and social complexity, to multiple use, multiple ecosystem and livelihood functions, and agro-socio-economico-ecologic complexity

- To respond to this complexity, management needs to be professionalized and present institutional reform models need to be evaluated and overhauled to respond to new demands and characteristics of farmers. Capacity building of managers and of intermediate service providers will need to be substantially boosted. Simplicity of operation and proper information will be required. The need to strengthen capacities also applies, critically, to consulting firms, and to the various components of civil society.

- Evolution scenarios, objectives and strategic responses will vary greatly according to the types and socio-economic environment of the systems. Non-rice drivers will play an important role in their evolution.

- Compared with recommendations made 10 years ago (FAO, 1997), new recommendations can be characterized as: moving away from generation of both positive and negative externalities by accident and from development of autonomous farmers' responses by neglect, to explicit management of multiple roles on the one hand, and to explicit recognition of farmers' service and other objectives, of their contributions to overall efficiency and productivity for instance by pumping, and of the costs thus incurred to them, and search for the most practical, economical options on where, how and at which levels (main system, intermediate distribution, farmers, conjunctive use, etc.) to locate improvements for service delivery.

- The main focus will remain the improvement of performance of existing assets. New systems may be still developed in predominantly agrarian economies, in ecosystems with comparative advantages, but their planning and appraisal process should be reformed to adhere to improved water governance.

Focusing on IMT and PIM, the key recommendations of the workshop, respond to the issues and problems identified through a review of the present performance of the existing systems, and to the future challenges that they will be facing. FAO, for this reason, fully endorses these recommendations for consideration in future IMT/PIM programs, not only in Southeast Asia, but also in other sub-regions, and stresses a the same time that they should not be considered in isolation, but as a part of a broader sectoral reform or modernization that encompasses institutions, management as well as infrastructure.

REFERENCES:

1. Barker and Molle, Comprehensive Assessment Research Report 5, Evolution of irrigation in South and Southeast Asia, IWMI, Colombo 2005

2. Burt, Charles, Rapid Appraisal Process (RAP) and Benchmarking Explanation and Tools, 2003 (http://www.watercontrol.org/tools/rap-eng-2002/files/Rapid%20Appraisal%20Process%20(RAP)%20and%20Benchmarking%20revised%20April%2018%202003.doc)

3. De Fraiture and Perry, Why irrigation water demand is inelastic at low prices ranges, Irrigation Water Policies: Micro and Macro Considerations Agadir, Morocco, 15-17 June 2002(http://lnweb18.worldbank.org/ESSD/ardext.nsf/18ByDocName /WhyisIrrigationWaterDemandInelasticatLowPriceRangesDeFraiturePerry/$FILE /DeFraiture_Perry.pdf) (http://www.iwmi.cgiar.org/Assessment/files/pdf/publications/ResearchReports/CARR5.pdf)

4. Facon, Thierry, Asian Irrigation in Transition - Service Orientation, Institutional Aspects and Design/Operation/Infrastructure Issues, in Asian Irrigation in Transition: Responding to Challenges. Edited by Ganesh Shivakoti, Douglas Vermillion, Wai Fung Lam, Elinor Ostrom, Ujjwal Pradhan and Robert Yoder, Sage Publications India Pvt Ltd, B-42 Panchsheel Enclave, Post Box 4109, New Delhi 110017 (India)

5. FAO, Modernization of irrigation schemes: past experiences and future options, FAO-RAP 1997/22, Water Report Series 12, Bangkok, 1997

6. FAO, Investment in Land and Water, FAO-RAP Publication 2002/09, FAO Regional Office for Asia and the Pacific, Bangklok

7. FAO, Burt, Charles and Styles, Stuart: Modern Water Control and Management Practices in Irrigation Impact on Performance , FAO Water Reports 19, ISBN: 92-5-104282-9, C.M. Burt, S. W. Styles.

   1999 (http://www.watercontrol.org/publications/files/wr19.pdf)

8. FAO Regional Strategic Framework, Bangkok 2005

   (http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/007/ad501e/ad501e00.htm)

9. FAO, Renault Daniel, Facon Thierry, Wahaj Robina. Modernization of Irrigation Systems, Volume 1: MASSCOTE – Mapping Systems and Services for Canal Operation Techniques. Irrigation and Drainage Paper 62, 2007, Forthcoming

10. Plusquellec, How Design, Management and Policy Affect the Performance of Irrigation Projects: Emerging Modernization Procedures and Design Standards, March 2002, FAO Bangkok ISBN 974-680-215-1 (www.watercontrol.org/ publications/files/design_publication.pdf)

APPENDIX 1

Typology of the large rice-based systems in Southeast Asia (from the Regional Workshop on the future of Large Rice-Based Irrigation systems in Southeast Asia, Ho Chi Minh City, 2005)

Table: Technical criteria

	Technical criteria	Main characteristics (and examples)
1	Reservoir-backed, gravity fed irrigation systems	Water is stored in large reservoirs, distributed via a canal networks to the fields mainly by gravity (Zhanghe system, Dau Tieng, UPRIIS)
2	Off-river diversion irrigation systems	Water level in the rivers is raised by dam so that water can be distributed via a canal networks to the fields (SCRIS, Philippines)
3	Off-river pump irrigation systems	Water is pumped into a canal networks, to be distributed to the fields (Northern part of Vietnam)
4	Integrated water management systems in the deltas	Low lying deltas, Consisting of a series of multifunctional canal networks (water supply, drainage, transport..) and water management structure (salinity control) and an mosaic small irrigation systems (tidal or pump)
5	Conjunctive groundwater-surface water system	Both gravity fed surface irrigation + groundwater pumping
Additional criteria	Urban-rural irrigation systems	Near or including cities or industrialized centers, steep competition for water and labor (Cu Chi, Zhanghe, Mangat)

Table: Socio-economic context[1] found to be most operational for the objectives of the workshop were found to be the following. Major implications in terms of goals and strategies were identified for each class.

National and Sub-national stage	Economic and Agriculture Situation	Strategy and policy
Focus is outside agriculture Post-agriculture/advanced	highly diversified agriculture Resources competition high environmental concern diets shifting need to conserve certain level of food production capacity on the way to diversification	Reduction/decommissioning of rice irrigation areas Specialization improve water productivity protect environment and water quality government investment for modernization
Agricultural export main focus Intermediate/transition	quick demographic transition further improvement of food security need to stabilize rice production rice exporting for FC earning+C6 rely on rice production	Stabilization and modest development of rice irrigation areas development of small systems increase the financial self-sufficiency further water resources development
Agriculture main focus Low developed/early economy	urgent need for food security possess comparative advantage Little alternatives	further rice irrigation expansion strong government financial support external assistance

1- Classes refer to national context or sub-national context as appropriate (agricultural export may thus be outside of the system area to another province).

APPENDIX 2: Major drivers affecting irrigation water management for larg rce-based systems in Southeast Asia[1]

Common drivers
o Food Security: National-Regional-Household. o Poverty alleviation/regional development. o Increasing concern for environmental protection and ecosystem management. o Issues of energy and other chemical inputs o Climate change (coastal impact- risk for rainfed agriculture).
Nation specific
o Development stage that set the exporting/importing strategy. o National Budget Support/Constraints – O&M cost reduction (may be a constraint) o Institutional reforms: Regional Autonomy – decentralization o Agriculture and water management policy o Migration rural/agri-urban population balance.
Other Drivers for Change
o Equity of distribution including gender concerns o Multiple purpose nature of service from reservoirs o Markets diversification and integration (need for crop diversity) o Pressure on Water resource: Scarcity, Water quality and competing uses of water o Reclaiming land.
Management related objectives/drivers
o Cost-effectiveness of O&M and management o More responsive, transparent and participative management o More flexible water delivery systems o Accounting for multiple uses of water o Water on Demand (removing technical constraints) o Technology: availability of low cost pumps
Accompanying supports (enabling conditions) /drivers:
o Strategies of the World Bank and Asian Development Bank for management/rehabilitation projects o Capacity building in water infrastructure management and service oriented management, in modernization development.

EVOLUTION SCENARII AND STRATEGIC RESPONSES

Considering the effect of different drivers, strategies and policies for all 5 types of systems in the three contexts/stages, the workshop developed likely evolution scenario. The following table is a synthesis of the outputs of the different working groups.

1- Source: Regional Workshop on the future of Large Rice-Based Irrigation systems in Southeast Asia, Ho Chi Minh City, 2005

APPENDIX 3: Evolution scenario and strategic response for large rice-based irrigation systems in Southeast Asia[1]

National and Sub-national stage	Economic and Agriculture Situation	Strategy and policy	Type 1: Reservoir gravity	Type 2: Off-river gravity	Type 3: Off-river pump	Type 4: Conjunctive	Type 5: Integrated management deltas
Focus is outside agri. Post-agriculture	highly diversified agriculture; Resource competition High environmental concern diets shifting need to conserve certain level of food production capacity link between water and multi-functionality	Reservoir decommissioning [illegible] Specialisation improve water productivity protect environment and water quality government investment for modernization	0 Optimizing multiple use economically justified: limited number of sites available for new systems	-- Reduce, Merge or neglect due to low reliability Convert to type 3 or 4 Convert to different crops/land use	+ Increasing energy costs Crop diversification Rice phases out economically justified; limited number of sites available for new systems	+ Highly flexible Farmers decide Market rules (export possibilities) (many users use pumps)	-- urbanization (Optimizing multiple use (environment, drainage issues peri-urban agriculture, urbanization); more crop diversification
Agri. Export main focus Intermediate	on the way to diversification quick demographic transition further improvement of food security need for exporting for FX earning (36 to stabilize rice production	stabilization and modest development of rice irrigation areas development of small systems increase the financial self-sufficiency	not economically justified by agriculture alone but may expand: Anticipate on multiple uses	0 Improve, modernize (endless) Inherent limitations of supply	0+ Likely reduction due to energy costs (for paddy)	+ Highly flexible Farmers decide Market rules (export possibilities) (several farmers use pumps)	Expand short term then decline due to urbanization, sea level rise, salinity? Optimize multiple use Expensive drainage (environment, drainage issues, peri-urban agriculture, urbanization)
Agriculture main focus Low-developed	rely on rice production urgent need for food security possess comparative advantage Link alternatives link between water, ecosystems and livelihoods	further water resources development further rice irrigation expansion strong government financial support external assistance	0 Too expensive for rice but plan for future or multi-purpose structure	+ low costs Comparative advantage (compared with other options)	+ Affordable investment Subsidized O&M	+ Highly flexible Farmers decide Market rules (export possibilities) (some rich farmers use pumps)	Expand short term then decline due to urbanization, sea level rise, salinity? Developing paddy systems Not yet urbanization

1– Source: Regional Workshop on the future of Large Rice-Based Irrigation Systems in Southeast Asia, Ho Chi Minh City, 2005

UNDERSTANDING THE IMPACT OF IRRIGATION MANAGEMENT TRANSFER

Mei Xie[1]

ABSTRACT

Poor or under-performance of many publicly financed irrigation infrastructure schemes have led to governments and donors seeking new approaches to irrigation management. While purely private sector management of public irrigation infrastructure is still a novelty for most developing countries, a semi-private or semi-public form of irrigation management has been emerging over the past decade – irrigation management through farmer water users' associations (WUA) or irrigators' associations (IA) or farmer water organizations (FWO) – as termed differently in different countries. These WUA serve as intermediaries for the public sector, within a broader context of participatory irrigation management (PIM). There has been a shift of approaches from largely government operated and managed irrigation systems to joint management of irrigation systems by agencies working with farmers. The development of WUA has led to irrigation management transfer (IMT) in some countries, i.e. the public sector transferring the management responsibility (a part of it) from a government agency to WUA.

While many governments and donors have made a great deal of effort and invested millions of dollars in WUA development and IMT, especially over the last decade, how much do we know about the impact of these IMT? Has IMT resulted in improvements in water delivery, in irrigation system maintenance, in reducing conflicts, in increasing water revenue collection, and in eventual reduction of agency cost? Has IMT resulted in impact on production and who have benefited? There is not much literature to document these impacts of IMT. We found few cases where comprehensive evaluation is carried out on IMT. In Indonesia and China, governments have carried out partial evaluations of WUA performance in certain areas. Still, little is known on the impact of IMT with back ups from field data.

Based on implementation of IMT under two World Bank projects in the Philippines, a World Bank team, working with the National Irrigation Administration (NIA) of the Philippines, attempted a study of IMT impact. The study, comprising three phases – farmer/NIA perception survey, technical and institutional in-depth review, and economic analysis of impact on production, used 63 IMT contracts that were

1- Sr. Water Resources Management Specialist, World Bank Institute (WBI), WBISD, 1818 H Str. NW Washington DC. Email: mxie@worldbank.org

implemented from 2-5 years as samples. The study included a comprehensive evaluation of IMT impact, by exploring assessment methodologies, design of questionnaires, and first-hand survey of farmers, WUA leaders and agency field staff who worked on IMT. Based on the results of the survey in Phase-1, the study continued with Phase-2 through an in-depth analysis of 12 selected IMT contracts that were judged as performing reasonably well and those judged as problematic. The in-depth analysis included a technical evaluation of the irrigation systems and how they may have affected the performance of IMT, and an institutional evaluation, focusing on performance of both WUAs and the government irrigation agency. For the first time, RAP (rapid appraisal process) and benchmarking methods were used in the technical evaluation of the irrigation systems while assessing IMT impact. Phase-3 attempted an analysis of the economic impact of IMT using one large irrigation system and its field survey data, comparing those with data from non-IMT areas. The study not only generated first hand field data from farmer feedback on IMT, linking physical design and operations with IMT implementation, but also provided lessons for those who wish to undertake similar evaluation of IMT performance in their countries or systems.

FLOATING DOWNSTREAM – WATER USERS, PARTICIPATORY MANAGEMENT AND SECTORAL REFORM – WHAT ARE THE MINIMUM CONDITIONS FOR SUCCESS?

Hugh Turral[1]

ABSTRACT

In practice, the rhetoric of participatory management in irrigation only becomes reality in programmes to form water user associations. There is clear global evidence that water user associations in medium and large scale surface irrigation systems struggle to be effective and survive, even in countries with strong cultures of collective action.

A number of different approaches have been taken to try to avoid stranding water user associations and other local participatory initiatives, in order to strengthen their governing institutional, regulatory and economic environment. Thus we see efforts to build federations of water user associations and representative apex bodies at main canal and even system levels.

A key process in establishing a more favourable environment for participatory management, or other forms of devolved responsibility and empowerment (franchising, privatisation, joint management) is the sectoral reform of irrigation agencies.

However, irrigation agencies often resist sectoral reform, the empowerment of WUAs and the attendant discipline of evolving a service culture. There are many reasons, including professional pride, the perceived importance of new construction and rent seeking activities in contract management and in the supply of irrigation water.

Thus, irrigation agency reform often considerably lags behind efforts to establish and sustain water user associations and their umbrella organizations. At the same time, higher level water sector reforms are implied in the re-structuring of irrigation agencies. Apart from internal budgetary pressure, and changes from a construction agenda to service orientation, irrigation agencies face a number of external pressures arising from the importance of agricultural water use as a major share of abstraction for human needs, including:

1) Water management and allocation at basin scale – including managing water allocation between:

1 - Dr. Hugh Turral, Theme Leader on Basin Water Management, International Water Management Institute, IWMI. Email: H.TURRAL@cgiar.org

a) Multiple and sometimes nested irrigation systems; and

b) Inter-sectoral allocation and competition (cities, industry, power and environment); and

2) The emergence of large scale, atomistic private groundwater developments, posing new challenges in groundwater governance and conjunctive use management.

The paper draws on examples from China, Pakistan, Central Asia and India, and contrasts their experience with the far reaching changes in the supervising institutional and economic environment that has guided irrigation and water sector reform in Australia in the past 15 years.

OPTIMIZATION OF IRRIGATION PERFORMANCE THROUGH PHYSICAL CHANGES AND INSTITUTIONAL REFORMS: THE EXAMPLE OF IRAN

Herve Plusquellec

During the last three days, the participants to the tenth International Seminar on Participatory Irrigation Management (PIM) have been discussing the issues and challenges of PIM in the field. They have shared their experiences in the three sub-themes of the seminar that are related to the PIM frameworks and models, organizational reforms, legal strategies, socio-cultural and political grounds and support system for PIM sustainability. Before coming here, I again read the invitation to this Conference. I found refreshing that the Chairman of IRNCID, Dr. Rasoul Zargar, was confident that this event will also offer an opportunity to all participants, scientists, engineers, specialists and others to exchange ideas and transfer technologies relevant to water users and PIM in Iran and other countries. I would like in this keynote to respond to Dr. Zargar by addressing the technical changes needed to support PIM.

It is increasingly accepted that combining physical changes and institutional reforms is required to optimize the performance of irrigation projects. I therefore believe it is appropriate to end up this Conference by addressing the complementarity of these two aspects. I will address that question by highlighting that our host country has already in place either the reforms or the physical infrastructure needed for modern irrigation in different regions of the country. However there are not yet examples where reforms and appropriate infrastructure are present together. Of great interest for the international community is the experience of Iran that is experimenting with an institutional arrangement which is expected to evolve towards privatization of irrigation management. That approach is seldom used in other countries, where irrigation schemes are managed either by government agencies or by organizations of user associations or jointly.

My involvement with irrigation development in Iran dates back to a few decades. I had the opportunity to visit a number of irrigation schemes in many regions of Iran: The large rice-based Guilan project in the humid region along the Caspian sea, the Dez project in Khuziztan, the Sistan scheme in the very arid Eastern region at the border with Afhanistan, the Duruzan project at a stone jet of Persepolis and the Moghan project with a Mediterranean climate in the North-East region. Irrigation has been practiced in Iran for centuries. Traditional schemes cover almost 5.9 million hectares, which are supplied by run-off river diversions and by groundwater such as wells, springs and the famous qanats. These schemes have been developed and are still managed by farmers. It is fascinating to observe how the local users in Iran and other countries have developed complex rules for the allocation and distribution of water among themselves and adjust to the various conditions of climate and variations in water resources in time and space. These schemes are sometimes referred as traditional, meaning they are simple and rustic. Indeed the management rules of these schemes are very sophisticated in some cases, in dealing with seasonal variations of water supply.

However the main purpose of my talk is with the so-called modern systems developed by government agencies. After a very brief background on the modern Iranian irrigation sector, I will discuss the institutional arrangements and the design concepts of large irrigation systems. We will then assess the performance of two typical schemes where either reforms or modern design have been adopted: The Moghan project in the Northeast region and the Drudzan project in the Southeast.

THE MODERN IRRIGATION SECTOR IN IRAN

In Iran, the modern area covering about 1.5 million ha consists in 55 schemes from over 100,000 ha (190,000 ha in Guilan and 125,000 ha in Dez project) to a few thousand ha. The Ministry of Energy (MOE) is responsible for the planning, design, construction and management of all main water systems in the country including all main irrigation systems and for improvement of traditional schemes. MOE mostly operates through its fourteen affiliated regional Water Authorities.

The Ministry of Agriculture and Jihad (MOAJ) through its Directorate of Soil and Water and its Provincial Agriculture Organizations is responsible for all the planning and development activities below the secondary canals. This includes construction of tertiary canals, land consolidation and land leveling, promotion and development of on-farm water saving techniques, including pressurized systems within modern and traditional schemes.

The activities of MOAJ generally lag far behind those of MOE within the modern systems. Although 1.2 million hectares have been developed by MOE in the modern sector, tertiary canals have been installed only on half the area and only one third has benefited from on-farm development. The main causes of this gap in investments between MOE and MOAJ are related to the budget and financing process of MOA works. The farmers should pay 30% of the investments through seven-year loans from the Agricultural Banks at 5% interest. In many schemes land consolidation is necessary to limit the number of parcels of each farm from about 5 or 6 to one or two plots. Land consolidation enables to optimize the layout of the tertiary and quaternary canals and ultimately the distribution of water through leveled fields. Progress in land consolidation is based on the mobilization of farmers by MOAJ staff.

For the reasons discussed above, of which the lag between the construction of the main infrastructure and the distribution system is likely the main one, the agricultural production in the modern system of Iran is far below expectations:

- The crop yields are below the potential indicating either deficiency in irrigation water or non-water inputs. For example the average yield of wheat is about 3 ton/ha, half the yield obtained in pilot farm tests in Moghan scheme.

- The volumes diverted for irrigation are excessive indicating excessive losses at farm level and poor operation of the incomplete distribution system. For example, an average volume of 40,000 m3 is diverted for sugarcane, 24,000 m3 for rice and 6200 m3 for wheat.

- The productivity of water (kg/m3 of diverted water) is two to three times below the potential.

However some schemes are performing much better than the average for reasons that we will discuss later in this presentation, which are related either to the institutional arrangements or a better water infrastructure.

INSTITUTIONAL ARRANGEMENTS

The Operation and maintenance of the 55 national schemes is entrusted to Operation and Maintenance Companies (OMC). As of 2004, only 19 OMCs were established. The responsibilities of the OMC are: i) to deliver water on a volumetric basis, where possible, to the users according to a contract signed on an annual (or seasonal) basis between the OMC and individual users stipulating the volumes to be deliver per crop, ii) to collect the water fees on a volumetric or per hectare basis and iii) to proceed with agreed maintenance activities. The OMCs signed annual contracts with their respective RWAs for operation, maintenance and administrative activities. The OMCs were established through decentralization of the RWAs in the early 1990s. The OMCs have no asset and do not meet the definition of private companies since they are still under the supervision of their parent government agencies. They are water service providers but are contracting with public agencies. The farmers are responsible for all O&M activities of the tertiary canals and below.

Informal user groups exist in a number of irrigation schemes. Under a recently completed World Bank project, water user groups were established in two schemes at the secondary level.

The present arrangements in which the RWAs contracted with OMCs are a transition between the government-managed approach of the past and the user participation envisioned for the future. The objectives of the Government of Iran are the decentralization and privatization of the management of irrigation systems. That approach deviates from the standard model promoted by research organizations and donor agencies after the successful transfer of irrigation management to user associations in Mexico and its successful replication in Turkey. The model proposed by Iranian consultants recognizes that both OMCs and User groups are equal partners in water distribution, which are bound by enforceable contracts. The OMCs are legally obliged to deliver water according to an agreed schedule on a volumetric basis to user groups and the users to pay for water and to distribute it below a certain level. At long term, the signing of contracts with OMCs would no longer be the responsibilities of

Regional Water Authorities but of a Federation (or Union) of User groups at the scheme level. Another approach would be that the Unions establish their own OMC under its direct governance, that is the typical model of direct management by the users.

The first step, which has not been reached in any of the schemes in Iran, is the creation of a Union of the user groups at scheme level and the election of a formal Board by the representatives of informal groups. (CHECK)

DESIGN STANDARDS FOR IRRIGATION AND DRAINAGE SCHEMES IN IRAN

We will turn now to the engineering aspects of irrigation schemes in Iran.

Standards and criteria selected for the design of irrigation and drainage projects has a strong influence on the operational procedures, on the quality of the service provided to the water users and ultimately on agricultural production.

Two types of design approaches are found in Iran reflecting the experience of the foreign consulting firms, which were contracted in the 1960-70s:

- The manual operation approach prevailing mainly in Khuziztan, consisting in installing manually operated gates, motorized or not, to control water level and flows. The flow delivered to the tertiary canals is either controlled by Constant Head Orifice (CHO) or a simple gate associated with a measuring device (Parshall or Replogle flume, or any flow measuring device).

- The hydraulic automation approach introduced in the Guilan and Esfahan projects in the 1970s and replicated to some extend in smaller projects developed during the last two decades. That approach makes use either of simple static devices to stabilize the water levels and flows in the canals such as long crested weirs, emergency siphons and constant flow modular distributors or float operated gates to maintain constant water levels upstream or downstream of the gates.

With only one or two exceptions, all the canals are operated under upstream control. The manually operated systems are very simple in design but are the most complex to operate since there is no consideration for operation at less than maximum design flow and no consideration for unsteady flows. These systems cannot be operated efficiently. The operators are not able to cope with the variations in demand and supply, the lag time between releases at head works and delivery points and the frequent adjustments of all the gates. Manual observations of the flows released to tertiary canals and gate adjustments, if needed, require three to four visits a day to guarantee that the variations remain within acceptable limits. The hydraulically automated systems require minimum staff intervention to provide irrigation water and adjustment of gates only when discharges from one level of canal to the next level are changed.

The sharp difference between these two design approaches is reflected in the performance of the Dez and Guilan projects. The average overall efficiency of the Dez project (25%) estimate in the 1990s was one of the lowest in Iran compared to the high efficiency of Guilan estimated slightly above 50%, which is a remarkable value for a predominantly rice project. The Guilan conveyance and distribution system is consistently equipped of automatic static cross-regulators and user-friendly flow regulators. Field staffs of schemes equipped with CHO gates in Iran and most other countries are not familiar with the procedures to use these devices. Delivery of water is not volumetric but based on staff "experience" in estimating flows.

During the last two decades, the Iranian consulting firms and the Regional authorities have assessed the viability of the two approaches and concluded that the manually operated systems are too demanding in terms of field staff work. Designers of these systems were not aware of the difficulties of operating the systems they designed.

COMPARATIVE PERFORMANCE OF TWO TYPICAL SCHEMES

I am turning now to the discussion of the above-average performance of two irrigation schemes. These two systems strongly differ in the management and the water control infrastructure. Both systems are managed by an OMC, but one is jointly managed with informal user organizations. One is a gated manually-operated system, and the other one benefits from some level of hydraulic automation. A detailed note on two contrasting large irrigation schemes is provided in annex.

> **Droudzan scheme**: This 46,000 ha scheme located about 50 km from Shiraz is managed by an OMC created in 1992 for managing three irrigation schemes. The OMC delivers irrigation water to 211 water groups representing about 10 to 100 farmers each. These groups have no legal form or even any formal organization. There are organized by Islamic Village Councils who encourage farmers to designate a representative for one or two villages.
>
> The canal system is equipped of manually-operated sliding or radial gates and the off takes to secondary canals are equipped of Constant Head Orifice (CHO) devices, properly maintained but not used according to design.
>
> **Moghan scheme**: This 75,000 ha scheme, located near the border with Azerbaizan, is managed by an OMC. However no formal or informal water groups have been created yet. Construction of the project started in the 1960s. The lag between the construction of the main systems and the distribution system was progressively closed in the 1980-90s.
>
> Part of the system is a manually operated gated system, and the other part is equipped with simple static and structures providing automatic control of water level and flows.

The dramatic progress in performance of the Moghan project during the last decades provides an example the potential agricultural benefits that can be obtained by completing a project infrastructure down to the farm fields.

The construction of the canaletti-type tertiary canals has considerably improved the reliability of water delivery to the farmers and more generally the quality of irrigation service.

Water is delivered to Moghan farmers on a 48-hour notice- under a pre-arranged delivery method. The overall project efficiency has considerably improved to over 42%. The well maintained control structures and the absence of vandalism of gates by farmers is an indication of the satisfactory water management of the Moghan scheme. In Drudzan water delivery is based on seasonal planning and not on demand from the users.

Although the staff of the Moghan OMC has been substantially reduced from 530 to 350, it is still far more than the staff of the Drudzan scheme (100 staff), which is one of the lowest found in developing countries.(one for 450 ha compared to one for 250 ha or less)

The limitations of the number of delivery points by the OMC to the user groups of Drudzan and the management of the system by these groups below the secondary off takes considerably simplify the task of the OMC.

Water fees are paid on volumetric basis in Moghan, although in some areas not fully modernized the volumes delivered to users is rather estimated that measured. In Drudzan, the fees are paid on a per area basis. The difference in calculation of water fee is related to the water control equipment.

Because of the good service provided to the users, the collection of water charges is excellent in both cases. However 40 percent of the collected charges in Drudzan cover the recurrent charges of the OMC and the rest is paid to the Regional Authority for investment in the region.. In Moghan, the charges only cover the OMC recurrent costs.

Obviously the ideal scheme would be one combining the advanced hydraulic infrastructure found in Moghan with the joint management approach used in Drudzan combining an OMC with water user groups. None of these two schemes has reached the advanced level of technology available today.. The user groups in Drudzan have no formal existence; and the control infrastructure in Moghan is not making use of the progress made during the last two decades in telecommunications and computer-controlled technology. However it seems certain that the combination of the approaches used for the development of the two schemes would have resulted in a highly performing scheme: a 2-day advanced delivery service, high efficiency and financially sustainable system

CONCLUSIONS

During the last two decades policy makers and donors have paid little attention to modernization of irrigation systems. Back in the 1970s and 1980s there was a school of thought that improved management could solve all problems and make any business profitable, including irrigated agriculture. There was a wide recognition that deficiencies in management and related institutional problems, rather than technology of irrigation, were the chief constraints of poor performance. The keynote speaker for the Gulhati Memorial during the Congress in Beijing in September 2005 rightly argued that neither improved management or water measurement alone are the answers to the poor performance of irrigation. Improved management may result in small increments, but not in substantial gains. Water management is a key component of water control, but it is not sufficient for significantly improving productivity by itself (Clemmens).

The manually operated systems constructed in many developed countries (Australia, U.S.A, Canada for example) are now under modernization through the installation of remote monitoring systems, remote control and automation of gates. This modernization was made possible though the progress made in the telecommunications and computer industries since the 1970s and the development of equipment suitable for the harsh conditions of irrigation schemes. Iran and other developing countries should seriously consider adapting and adopting these new technologies for improving their irrigation schemes.

Worldwide water-related issues are given great attention in international events such as Water Forum and others. However failures to address the links between the technical improvements of large and medium scale irrigation systems and management reforms are exacerbating the problems of water scarcity and threatening food security, water supply and environment. The shortages of food production predicted for the early 2000s have been averted because of the explosive exploitation of groundwater in many countries associated with a manifold increase in water saving application techniques in groundwater irrigated areas. However mining of groundwater and deterioration of water quality has occurred in many countries particularly in arid regions, affecting the poorest users, and threatening potable water supply projects. There are no other easy and cheap solutions to the food security and water issues. No further complacency is acceptable in addressing the long-standing issue of poor performance of surface-water projects.

RECOMMENDATION

I would like to conclude with a recommendation on the international organizations dealing with irrigation issues. This might be beyond my mandate of keynote speaker in an INPIM conference. However I feel I can do it in the position of External Reviewer of ICID.

IIMI was created two decades ago when it was widely accepted that the poor performance of irrigation was mostly related to institutional aspects and not to the technology. IWMI has now shifted to overall water issues and long-term projections related to food security and other global issues. Two small but efficient organizations were created later: INPIM and IPTRID. IPTRID was created at the initiative of ICID and the World Bank to complement IIMI activities by addressing the technical aspects of irrigation management. INPIM was also created at the initiative of the World Bank initially to promote the successful IMT program of Mexico and more recently to exchange the different experiences in institutional arrangements, including privatization of water services.

My proposal would be to strengthen the synergy of these two organizations, which are really complementary, through an arrangement to be defined. The above comparative performance of two schemes in Iran provides an indication of the potential benefits that could be achieved in associating physical changes and reforms.

The 4th Asian Regional Conference &
10th International Seminar on
Participatory Irrigation Management

Tehran-Iran 2-5 May, 2007

Theme 1

A Review on Participatory Measures in Irrigation

PARTICIPATORY IRRIGATION MANAGEMENT PROCESS IN GILAN IRRIGATION NETWORK "EXECUTIVE METHOD, EXPERIENCES AND ASSESSMENT"

Lida Rashtchi[1]

That is who sends rain from the sky and created plants, seeds and clusters by means of it. Look at the fruits… in fact in all these processes, there are signs for believers.
The holly Quran, Surachs Ana am – Verse 99.

ABSTRACT

The relation between man and water means his relation with life, civilization and his love to the creator. One of the proposed methods for maintaining water sources and decreasing expenses in the modern cultivation is the management of water sources. Gilan like other regions of Iran suffered a lot of geographical an a cultured changes while governor's conquered and struggled on the division of borders and lands.

Ater a period of rapid development of areas under watering, many governments understood that investing on collecting water –rate for providing the current annual expenses of the network is difficult and Gilan irrigation administrators haven't be succeeded in collecting water – rate.

The transfer of watering management means the transfer of power and responsibility of watering systems from other governmental organizations to WUA and rural cooperative companies were suggested as the first step. Finally from the proposed list 3 villages have been selected from Gilan's 3 irrigation regions and mentioned for the beginning of the discussion in commission regulations.

Care, uncertainty, lack of trust, these 3 subjects were inseparable pre-supposition of farmers thought against proposing any new subject by the government. At the end of 2 – month activity, from 3 leader villages, in two villages "kiasara" and "siagoorab" a council formed and the member of it had been selected, but in Roodpish that negative attitude was still stable. the first result of farmers cooperation on in helping government for getting better result in watery appeared. Villagers in the form of cooperative changed from sole consumers to assistant of government for getting the improvement goal, and they expressed their critics and critics and suggestion this shows that till farmer benefits from is the responsibilities, has enough motivates to accept the

1- Irrigation Expert, Gilan Regional Committee on Irrigation and Drainage (Affiliated to IRNCID), Iran.
Email: aida_rashtchi1361@yahoo.com

responsibility. Before the begging of watery season of the year2004, the discussion about transferring the responsibility of Fomanat irrigation network to cooperatives was proposed by Gilan common committee and regions water, because this idea was quickly! Unfortunately the level of reciting in offices and so in Fomanat issues decreased a lot, and did not succeed though several sessions were held and the trend of Cooperative operations from the contractor company (exploitation) to Gilan regional water were reflected and were mentioned in water consumption committee, but the operation company welcomed the WUA Cilan for year the seemed.

Fomanat affairs tried to justify Cooperatives by holding weekly session. That is, supervision was followed more seriously in comparison with the last year. The discussion stated in those sessions included solution and attempts of personnel which was given to the Cooperatives. Gilan WUA Cooperatives, in the 3rd years contract, didn’t receive any new. Important by the governmental organization. But the Cooperative themselves didn't show interest in making contract. The number of these Cooperatives reached 6 from 31. And till the and of December of 2007 this number were nullified for the seven weakness in receiving and not doing its duties according contract with operation company. Gilan should show all the achieved results from forming councils in past 3 teem and considered all the aspects and start again. We hop the feature of this council in our ever-green lands. Although we acquired training and experience in this trial and error. If Gilan as a special geographic condition in the semi dry country Iran can reach to the high figure in the connection water star up to about 10 years, it is a guarantee for the price of rice, tea and olive in Iran … and this is possible to improve the huge management.

1. WATER BLUE IN GILANIAN'S VIEW

The relation between man and water means his relation with life, civilization and his love to the creator.

The almighty god, created the whole world out of water after creating table, skies and throne. The civilization formed on the crossing of flowing water. Also in Iran wherever there was a river, the speed of cultural growth has been increased.

The lack of unenvied water sources has made serious anxiety for the world and its live creatures. One of the proposed methods for maintaining water sources and decreasing expenses in the modern cultivation is the management of water sources through public councils or non – governmental organization, so-called ***WUA***, which the world tends toward it, too.

These councils all over the world are working with different titles but with the same purposes and their difference in nature is only in their local regulations and environmental conditions and characteristics but the general aim for their formation is the same: decreasing the government role and developing water consumers and other local institute roles in the management of watering.

The plains of Gilan with the average – annual fall of 1200 mm in comparison with the one of 250 mm of – the country and the role of 800mm of the world is considered as on of most rainy region in Iran.

Although this province has passed the anger of nature in the form of drought or over flowing of rivers, unpredictable floods which ruined the result of Gilan farmers hard efforts at once.

What completed Gilan watering industry and changed it from completely elementary style beside rivers to the everlasting art is unsuitable rivers flow, in consistent, fall in different months and lack of needed water sufficiency for growing plants.

People living in Gilan acquired that with the help of a simple way but by considering technical points and knowledge of related issues to changes in river – bed, they can separate the major rivers of Gilan like ***Sepidrood***. For this, they put tripods made of trunk ot the oprning,outh of major rivers, beside ***Sepidrood*** and the distance between tripod was fasten by the use of branches and leaves of trees this mass of branches and leaves is locally called "KHal".

For more security and preventing of tradition of river's over flowing in farming areas, and possible breaking of its wall, they maintain the level of soil, at suitable height of water level, so that the extra water evacuate to ***Sepidrood***, before entering the open mouth. This area was called "shatok"

So the people of Gilan by the hope of getting daily bread left the name for farming since dawn and want to holly shrine which was a place for respecting to creator of water and praising for his blessings. In Gilan culture rivers, lakes, springs and mirage have special place in view of religion.

Live memories of the relation between blessing and water have been kept in historical memories of the region which some of them are:

Saving rain prayer, praying to goddess "Tashtar", the principal of rain and doing ceremony for "asking rain".

"Marlik" which had the picture of mythical creature has been found on a golden pot – shaped dish with two lines shaped heads, two spread wings and had fishscale on its feet that is sign of a God who guards water. Because in Iranian culture, generosity and guardianship and the use of fish picture is a symbol of blessing, the aforementioned sets, are symbols of "Anahid", head of water ladies, who has all of these symbols in herself.

Gilan like other regions of Iran suffered a lot of geographical an a cultured changes while governor's conquered and struggled on the division of borders and lands, these changes has separated the culture of civic and rural and gradually created the currant situation. Villages have become separated and for each village they appointed land lord, the amount of owner ship and water portion for each village of the shared source like river as well as the portion of each owner were recorded in a document called *"tomare Ab"*. This document has been signed and sealed by the person in charge of water council or trustable people. All these spontaneous regulations, which had executive aspect and were based on the local management, became as the basis of watering management in Gilan.

The science which our antecedents established by the simplest and the most primitive equipment is a remarkable sample of most powerful local management and the evidence of this claim is the example which we will discuss later.

2. TRANSITIONS TRAVELING LOCAL MANAGEMENT IRRIGATION IN GHLAN

According to historical documents, rice planting in Gilan in 1906 equals to 104000 hectare. About 1961, that is the time of establishment of Sepidrood Dam and installations and related buildings all over the province, no change has been seen in the under – planting area. Because extending of rice planting was dependent on supplying water and around the natural sources of province was completely limited but after the establishment of water canals and water supplying installations this extending started considerably and gradually formed the present under planting area that is about 170000 hectare. The question is:

Had we thought about this development in the primitive planning of Sepidrood establishment and the other components of Gilan modern irrigation network?

It's clear that planning a program covering a province would require a view of the future, But this unplanned development does not match with the future plan.

There are same factors which caused decrease of exploitation of the system which includes: decrease of efficiency in water transfer, as the result of decrease in supply, tears and wear, lack of exchanging the used and torn installations as the result of lack of sufficient budget dedication and this is not specific to Gilan.

After a period of rapid development of areas under irrigation, many governments understood that investing on collecting water –rate for providing the current annual expenses of the network is difficult.

Now if collecting all this debts is not possible, that is government has not enough lever for encouraging the farmer to pay the water – rate, the governments ability and power of man oeuvre for reconstructing the net work and building installations in line with planting development will decrease, that is the event that occurred exactly in Gilan.

Why Gilan irrigation administrators haven’t been succeeded in collecting water – rate?

A: Network deficiency in complete covering of consumers of farming – water and attracting the satisfaction of subscribers.

We described in detail the weather Conditions of Gilan. A province which is cloudy for more than 6 months a year. During the rain seasons all the lakes are full of water, but this is not all. The way of sending these sources to farming lands is something that was disputable between farmers and administrators since the establishment of government watering organization, because many farmers believed that water is a granted blessing and it is rainfall which survives watering in Gilan and in fact, governmental organization portion in providing the equipment for distributing and transferring water is nothing.

During the 10 past years between 1996-2006 Gilan has passed unpredictable drought for two times and overflowing of seasonal and permanent rivers for several times that in both cases governmental organization was seeking a remedy without any predetermined strategy.

In other words, this province was completely unaware to drought disaster and has not enough levers to confront unpredictable floods. In both cases the percent of planning an prediction for confronting with danger is zero. (In fact after the occurrence of disaster and resultant damage seeking or remedy starts). Perhaps the reason is proving governmental organization role in providing water to subscribers is a little difficult. Because the farmer does not have governments support and help he deserves and because of governed atmospheric conditions he sustains a loss.

In the best and desired conditions delivering water to the network and subscriber farm is unpredictable and immeasurable because water control and measurement devices are torn for years and doesn't have the primitive efficiency or are completely used and are removed from the region and the government didn't have capacity to substitute them. In this province the occurrence of seasonal rainfall pour massive bulk of water to the transfer lines at once. the surface drains heed a careful inspection, and surface drains need a careful inspection, and making concrete riverbed to have the ability of evacuation against water oozing through a stream. But many of the evacuation lines of water oozing in Gilan have been a bed for weeds and lost their efficiency or have been blocked completely. Just a moment suppose yourselves instead of Gilan farmers...

Do we expect him to pay the water – rate only based on 45 – year networking without knowing whether he has got water or how much water he has got exactly?

B) Not hiving enough executive lever for receiving water – rate.

Based on specific conditions of Gilan topography, lack of flat farming lands, enough opening mouths, exact control tools and cutting farming water, there is no possibility to confront with those consumers who postpone the water – rate payment. The worst kind of confront with offender is warning and fining properties that in many cases it doesn't help greatly to the water – rate payment.

Suppose in a non – flat land, upper region farmer refrains from paying water – rate and lower region pays the water – rate on time. Water, based on graving watering trend in gilan flows from upper region to the lower region and in the case of water cut of upper region, the water of lower region will cut too.

Even in the flat lands, there is no exact way for blocking water on offenders.

All these mentioned problems in the beginning of 2000 made Gilan irrigation administrators trend to public participation plans in watering in line with the country and the world while looking at the previous watering methods plans in which farmers as the subscriber of farming water will participates in water transferring activities with greater interest and the focus of government – investment has changed from performing perfunctory and daily improvements of irrigation perfunctory networks to fundamental reconstruction, development and creating network and control on public councils.

3. THE BEGINNING OF PLAN WUA PRIMITIVE ACTIONS, OBSTACLES AND LIMITS

In line with long – term goals of efficient farming water consumption, by – laws of this plan in 2/5/1994 approved by the minister council. One of the goals of this plan was attracting the farmers' participation in efficient consumption of farming water and fair distribution of water with the help of two ministries of power and farming. Article 5 of this by – low required all the organization affiliated to water to users the current farming ministry was responsible to from and organize the lawful and suitable councils in lands under the irrigation network at most two years since approval date.

Since the execution order of this plan Agricultural organization, as the agent of organization of province, and Exploitation Company of watering and draining network, as the agent of regional water of province, announced their readiness for starting the plan. But from which point should we start?

Pure lands under rice planting in Gilan about 170000 hectares and the number of subscribers reached to 280000 in 1994.

Plan was completely being tested and no proposed prerequisite or primitive test which was done. Certainly none of the two aforementioned governmental organizations thought about sudden performance of the plan all over the province. But choosing the start point seemed so difficult.

The primitive studies which were written in identification of research documents of Exploitation Company(gilan irrigation and drainage network operation company) shows the nature of bulk delivery of water was not clear for the user at the beginning and after issuing the final order.

The transfer of watering management means the transfer of power and responsibility of watering systems from other governmental organizations to ***WUA***. This definition is so general. In fact for concluding from this transfer of power we should pay attention to narrow down this issue considering economical – local regional conditions and also problems which governmental organizations were confronted

Is the purpose of management transfer to transfer control of network in the distribution and transmission section?

Do we intend to reach a common management of "organization – consumer"

Do we need the council just in receiving section of water – rate

Finally after discussing all the equipments, deficiencies and existing problems, in the middle of 1995, the Agricultural organization announced a list of eleven rural cooperative companies to Exploitation Company which has articles of association and was recorded for many years. The fist session of 3-persion commission, was held, was held in December, 1998 in front of agent of – regional water of Agricultural organization.

But why rural cooperative companies were suggested as the first step?

General cooperative office before suggesting *water user's association* found the effects of making a relation with farmers in the form of public group and this plan resulted in rural association company. Rural association company at the rural level took the responsibility for supervising warehouse, sale distribution and pricing farming products and other farming products.

Considering discussion that was held by the villagers and rural councils and also considering discussion and lack of motivation and readiness' farmers the commission proposed that for now the activities of councils should start from those regions that has cooperative company or equipment plan and reconstruction was done there.

The first discussion session held in the form of five educational work-shops from October till February 1998 with the presence of managers, regional water organization experts and Gilan Exploitation Company experts and the helper company, called: "pandam", the participants examined the systematic history of the people in charge of Gilan watering who had paid attention to related affairs of water, by reference to the role of local council of the province in water management.

They agreed that the gradual disappearance of traditional ways of water, management and the confront of Agricultural system with the current problem is the result of governing of completely governmental system and the fading role of people participation in watering affairs. In addition executive directors of Gilan irrigation believe that although Gilan has life – long proportionally network, and tear and wear, yet is incomplete in many parts and the exploitation of them is uneconomical and non – technical. Finally from the proposed list 3 villages have been selected from Gilan's 3 irrigation regions and mentioned for the beginning of the discussion in commission regulations.

1- Village "Kiasara" from the central reconstruction
2- Village "upper "Siagoorab" from reconstruction D2, east of Gilan.
3- Village "Roodpish" from reconstruction F1, west of fomanat.

The next step was discussions with villagers.

Care, uncertainty, lack of trust, these 3 subjects were inseparable pre-supposition of farmers thought against proposing any new subject by the government.

why does the farmer have a negative attitude to proposed changes by government Gilan farmers complained the low base price of rice, not being able to purchase their products, lack of Agricultural machines, vulnerability against natural disaster and its effect on the product reduction, lack of insurance for their agricultural product, the existing strict on paying loan and the rural council's lack of executive power. These points were mentioned in the introducing session sponsors and villagers. *pandam counseling company* in addition to determining the goal and importance of farmers participation in village – water issues – considered the beginning of this plan as a way for enhancing the farmers ability in developing village and salving their problems.

During holding 3 work-shops the desires of government agents from foundation of councils were mentioned in this order:

1 – Determining the council members, formation of irrigation– management expert group, equipment management, mechanization, collection, setting articles of association for dictating the duties in details.

2 – The effect of public power for receiving postponed and current water – rate.

3 – Cooperation in performing improving and reconstruction plans and preparing it for welcoming the new water year.

The candidates of 3 – people commission for conducting and fallowing villagers' activities, visited the leader villages and saw the program by themselves. At the end of 2 – month activity, from 3 leader villages, in two villages "Kiasara" and "Siagoorab" a council formed and the member of it had been selected and the expert group in those villages formed the major activities of this council are: encouraging villagers for paying water – rate for the years 1998, and performing several reconstruction projects like opening mouth repairmen, cutting and welding of wed trapdoor which all of these, activities were done by the villagers themselves, but in Roodpish that negative attitude was still stable, undesirable performance of currant stacking company, lack of relationship between administrators about their problems, gradually paved the way for uncertainty toward government promises and the effect of This issue was so deep that with two month continuous gilan irrigation and drainage network operation company , there was no hope to the future. The members of the commission, sometime among simple speeches of villager confronted with the most basic problems which resulted in the lack cooperation in Roodpish. The transfer condition was not clear for the Roodpish farmers. They were worried unsuitability of government policy for maintains these public councils. The range of power support teed relationship bet councils and governmental organize responsible for province water, was not clear for villagers. Many villagers agreed with the councils, if and only if the exploiting company of Gilan irrigation and draining network has no portion in reception or the payment of water-rate to the governmental organization will be cut, the fact is that since the year 1999, the first steps for framing these associations were taken till about last of June 2002, that expositions of rural cooperative in gilan were exanimate, the mentions issues remained and the efforts for holding a council in Roodship didn’t succeeded although two mentioned cooperatives in "Kiasara" and "Siagoorab" effected considerably an the receptions of water-rate for the year 2000 and their article of association was set too but none of these two organizations have been recorded because of expenses.

But the result was that it simplified the subsequent decision of common commission for selecting the next region for experimental execution of the plan. Conceding the progressed of siagoorab public associations in east of gilan, 2 cooperative companies "kisom" and "kacha" were selected as the best samples, because they had positive precedent in producing and promoting profitable activities.

During a gathering with the members of common committee and execute directors of cooperative companies, the goal of bulk water delivering and transferring a part of distribution activities, repairmen and keeping the building and also receiving the farming water-rate for cooperative member were explained. The directory of cooperative companies emphasized a lot on a contact bet cooperatives and Employer Company. The gilan operation company also emphasized on receiving affair.

Simultaneously, kisom and kacha cooperative companies prepared an assessment of performing expend and services related to water distribution and delivered it to the provinces common committee but in this assessment no plan was mentioned decrees expenses at the sometimes cooperation asked for a separate credit for keeping operation and repairing watering canals.

These opinions were announced to the employer (Gilan regional water company) by the gilan operation company. Then the two cooperative company experimentally started to distribute bills and receiving water-rate at the and of watering season. By company the repairmen and reconstruction the irrigation building season, exploiting company started repairmen the trapdoors of Kisom and Kacha a river sooner than other around villages. To create motivation and attract formers participation also the problem of passage's bridge river basin become and of the major points and the credit were provided for it. These issue made farmers, local associations and kisom' and Kacha's cooperative happy, on the other hand stimulated competition and curiosity of neighboring villages to benefit. At the begining of the second contract of mentions cooperatives (spring 2003) considerable opinions were reflected to exploiting company in stead of board of managers of these 2 cooperative. Less than one year the councils in line with the movement toward getting and receiving water-rate and reconstructing network believe that for keeping the value and importance paying of agriculture water-rate we should determine a lawful fine according to regulation for postponed bills.

To maintain annual water-rate according to rice final price each year-like current water-rate-and attracting bank's cooperation on in receiving account's liquidation at the time of paying agricultural loan to farmers were other points that cooperatives has reached for improving reception. So, the first result of farmers cooperation on in helping government for getting better result in watery appeared. Villagers in the form of cooperative changed from sole consumers to assistant of government for getting the improvement goal, and they expressed their critics and critics and suggestion this shows that till farmer benefits from is the responsibilities, has enough motivates to accept the responsibility.

4. WUA IN GILAN IN DEVELOPING STAGE

Before the begging of watery season of the year 2004, the discussion about transferring the responsibility of Fomanat irrigation network to cooperatives was proposed by Gilan common committee and regions water.

The exploiting company announced its disagreement to this transfer, there were a lot of points in this regard that seemed ambiguous.

We classify the reasons as below:

1- Kissom and kacha's WUA Cooperative, Covered two villages in the east of Gilan that in comparison with area under Fomanat watering was nothing. Performing the plan in this area. Coinciding the vast under covering area was a great risk.

2- The primitive results of cooperative councils in the village, Roodpish that is a branch of Fomanat watery affairs, was not satisfactory at all. Fomanat, Roodpish, in2000, had the most negative reaction to the foundation of WUA councils among 3 leader villages, and this issue doesn't promise good start.

3- According to the common committee opinions, Fomanat WUA cooperative in 3 major classifications.

   - Water conduct and transfer to the under covering area.
   - Fallowing reception of current and postponed water- rate

- Keeping and maintaining network installations and buildings affiliated to it: this was in a situation that rural productive cooperatives (new responsible of watery affairs). They didn't have any experience befor that.

By reviewing all these points, the idea of using cooperative in Fomanat affairs were considered quickly, but according to communicated policy by the executive orgs of plan, the primitive searches started in some area, Foman and Shaft regions and During it, 31 rural cooperative companies and major characteristics of under covering villages, that is, area under planting and the numbers – of subscribers of each village – were determined.

The head of cooperative of each city in addition to the studying of contact draft, which was to some extent like the contact between Kisom and Kacha cooperative, announce their readiness to start the work and determine the percent of wage to Fomanat watery affairs and they set the original contact:

The direct employer of this cooperative was the exploiting company and it was committed to do the fallowing:

1- Delivering needed water on time according to preset program and table at delivery time. This responsibility against cooperatives was considered as a unique consumer and the company against every individual of WUA region had no responsibility.

2- Providing exploiting instructions and keeping watering and drawing networks, needed plans, statistical and informative form and communicating newly approved regulations and rules.

3- Sending all circular letters and related instructions with contract subject before watering season Basic repairmen including network improvement, trapdoor exchange, concert canals and buildings repairmen.

4- Cooperative in getting needed authority, from governmental and nonagon orgs and systems mentioned in contract.

5- Required cooperation and harmony with cooperative in respect with taking all governmental rights mentioned in contract.

Rural cooperative companies were also obliged to the following commitments:

1- Conduct, transfer and water distribution inside the under covering lands of each for each cooperative and water distribution of delivery point in consistent with level and type of planting.

2- Following the reception of water – rate including current and postponed one against law and regulation.

3- Keeping and maintaining network installations technical building canals and drains in the limit of activity of each cooperative.

4- Regulating all roles and communicated instruction from the company according to contact articles.

5- Identifying and introducing offenders in relation to responsibility cooperative in the limit of activity (including those who took action to occupy) possessed lands of regional water like canals, drains or started to take water illegally.

6- Lack of receiving any kind of money as a water-rate directly and the lack of reception of any kind of new subscribers.

As per this mentioned contract and commitments Fomanat watering conduct in the mentioned formally transferred to cooperatives, commitment of speech is somthing, but the commitment of action is somthing other else. Because this commitment has been formed recently in the instruction of Fomanat *WUA* cooperative companies, exploiting company was at the top of watering operation to promote cooperatives. The aforementioned watering offices heads, along with executive director of cooperative companies according to the daily program m visited all the traditional branches and rivers, and in an agenda. They reported the comparison between, rate of progress of the plan to the Fomanat affairs.

The administrators of offices of contract party were involved in watering (in fact the contract with cooperatives did not reduce the network operations), on the other hand they were training the cooperative) which were working. And this trial and error-at the time of watering-caused the slow-running of operation than making any advantage for it.

The region in the first experience passed a lot of problems. In this experience, the exploiting company confronted with a lot of reparation: the justification of Cooperation in watering, seasonal water administrator in accepting Cooperatives as the employer and making the contract, supervising the Cooperative operation and the return of supervising on watering administer operations and installation contract (that in fact was Cooperative duty), solving the watering major problems that Cooperatives didn't know it just because of being novice. (Like turn-taking program, time of water blocking or setting opening mouth for performing turn-taking).

We classified the problems into two major groups:

A- The problems of watering season production Cooperatives didn't have any opportunity for performing watering program. Their watering experiences differed from their academic information and the program of water turn-taking was not performed in many under covered Cooperatives.

Water administrates of Fomanat region did not accept to make contract with these Cooperatives because of their weak watering management at region level and they referred to watering offices to solve their problems and mention the deficiencies.

B- The problems of receiving section from one perspective, the Cooperatives couldn't receive more than the middle level. The considerable point is that in the contract of these Cooperatives was the 5% increase in the received wage and considering 18% of receiving (current and annual) as the Cooperative wages cause 6-percent increase in company expenses that must be provided by 56-percept received wage, and this issue put exploiting company in critical financial situation.

According to performed programs and exact supervision of offices heads on reports which were based on the amount of Cooperatives receiving in their district and against their warning based on lack of suitable reception from the beginning of fall to its end, non of the Cooperatives could perform the predetermined programs.

Unfortunately the level of reciting in offices and so in Fomanat issues decreased a lot, and did not succeed though several sessions were held and the trend of Cooperative operations from the contractor company (exploitation) to Gilan regional water were reflected and were mentioned in water consumption committee. But what were the reasons of all these deduction? Common committee mentioned the following reasons as the major problems of the performance of Cooperative plans in several sessions and expert discussions.

1- At the end of December due to the verbal reference and repeated complains of some of the farmers in some villages of Cooperative district and their claim which was based on lack of reception of water-rate bill and following and investigation of offices managers of determined districts, it was reverted that many subscribers didn't receive any bill.

Some of these bills were given to coffee shops which were distributed by Islamic council and previous water-distributors and some of them were delivered to watering office (re-operation and the increase of bill rotation).

2- A large portion of paid wage from water-rate reception belonged to rural Cooperative organization and the portion of WUA Cooperatives was so little and this issue caused discouragement, lack of motivation in collecting sufficient water-rate from Cooperative part.

3- Training to prepare Cooperative members to accept hard responsibilities of watering season and also the period of reception, improvement and repayment was not enough or it was not formed coherently in due time because the amount of rain in comparison with previous year in the Fomanat watering installations section was more wide-spread and in lack of Cooperation of exploiting company in transferring heavy installation and lack of the preparation of opening-mouth of watering, Fomanat region was not exploitable for next watering season also the need for drawing soil and sediment most of the rivers were not removed till the end of 83 and in this case the probability of lack of watering was felt.

4- Villagers lack positive attitude to rural Cooperative records that was one of the major reasons for the lack of their Cooperation with Cooperatives clear reasons for the lack of familiarity of Cooperatives with network management lack of introducing of new duties to Cooperatives and unilateral orientation and making hasty in transferring the duties to Cooperatives.

At the end of 2004 because at severe snow, receiving decreased and there was no hope to Cooperation practically. So executive forces of exploiting company for compensating a part of resulting damage during exploitation of network in watering season and gradual transfer of information to Cooperatives, the common committee with the help of rural Cooperative organizations and managers stated to hold educational period from the middle of February year2004, mentioning some of the native cases that may not have a reason or excuse out of the province. But they were necessary in encouraging Cooperative to receiving for example it was proposed that extra water-rate receiving to be paid to farmers by the Cooperatives at the season of poison Fertilizer distributions to have the required motivation for attracting the farmers participation at the end of year 2004, on session with the presence of the common committee members were held. The first year the plan performance finished at Fomanat and deficiencies and problems were mentioned. Now at the threshold of new water year, the exploiting company insisted on doing some preparation to present this problem to be reported again in Foamnat affair. In this session, Gilan rural Cooperative agent, by referring to the lack of incomplete contract performance and lack of extra payment of Cooperatives against. Performed collection stated that because the transferred duties and commitments, has not been performed completely, evaluation been performed completely, evaluation is too soon and it's better not to change the transfer plan of water distribution management in 1383 in the next period a better evaluation should be done.

The members of rural Cooperative org, also people in charge of salary mentioned incomplete payment of water-supply and stated that: Considering water distributor as a people who do lots if important things, the decrease in water-rate receiving should not have negative effect on their salary. It is important to pay their salary on time so that they work with higher motivation at have a better role in this process.

Agents at Gilan water region, gathering in one common session, asked exploiting company to pay the amount of money agricultural to Cooperatives, under any condition so that the regional water org act to financing. In two cases of the contract articles that is, "definition of good working" and "payment of water-administer wages", the order of exiting and if needed reviewing, was issued. The difficulty of lack of informed manpower has also been examined.

The agent at rural Cooperative of "SOMEE SARA" (one of the cities in Fomanat which included many Cooperatives) stated about the method of Cooperative member's training: Considering the high age of members transmission at subjects is difficult, than the method should be in harmony with their level of actual and field operation and planning to visit dams, supplying establishments out water-transfer by Cooperatives was included in the educational program.

The last spring (2005), exploiting company began to set watering plan and Fomanat Also was under covered in this plan by providing this plan, daily and monthly portion at Fuoamn original canal's watering and it's related branches to the end of second-class canal will be determined. The date of canal's end of August 2005 was determined and contractors of Fuoman original canal lining project according to companies, communication acted to collect their tools as soon as possible according to the contract, range at exploiting company, duties was related to first and second class canals and delivering water at the begging of second class canals to Cooperatives but like the last year, announced its readiness for helping and Cooperating. However, the reelection of existing problems in network should be announced to expelling company much sooner that spring and lossore watering season.

One of the actions that done by Cooperatives about water-rate receiving affairs for April and May and in the distance bet two watering –warning sessions in the year and begging at watering at the year of 2005, was distribution at agricultural chemicals (Poisons and Fertilizers) inputted of occasionally tensions in the region it caused little progress in receiving and so, only those farmers who pained the water-rate cold use Cooperative portions like poisons and Fertilizers.

Before watering season these reforms were performed in the mentioned contract between Cooperatives and exploiting company.

1- Cooperative does not have the right of transfer saving back account.

2- From any payment amount, deducted for commission of water-rate collection to Cooperation and this sum will be kept as a deposit account in exploiting company. Half of this sum will be returned after the final approval and the rest will be returned certain delivery.

3- Every dispute should be transferred left to supervisory system or authorities (it should not be left to local judgments).

4- Increasing commission at the annual water-rate collection. Because of existing problems for collecting postponed water-rate.

5- Pay regalement of water-administer wages and insurance to prevent problems.

So, the operation company welcomed the WUA Cilan for year the seemed.

5. AFTER TWO YEARS EXPERIENCE

Fomanat affairs tried to justify Cooperatives by holding weekly session. That is, supervision was followed more seriously in comparison with the last year. The discussion stated in those sessions included solution and attempts of personnel which was given to the Cooperatives.

Did we intend to convert people who had only one experience in *WUA* Cooperative management to informed people in watering yet Cooperatives were so defenseless against sudden is seasonal problems in watering and many people referred to watering offices in the year 2005. Many tools like opening mouth, trapdoors were damaged as a resulted misusing and lack at experience in keeping and marinating. And in a few regions there was an stream of backward Ares timed turning water. Sever need to expert and responsible people in the level of Cooperatives made common committee to bring up a plan for using agriculture gradates who were the members of Gilan agricultural management system, in *WUA* Cooperatives. In the first days of July 2005, Gilan common commission invited the authorities of management system.

It was determined through the states of this members that among 2880 agriculture graduates who were also members at the system, many at them worked in offices and organizations, some had a free job and some other were completely unemployed. Organizing these forces in the form at councils can be useful.

The organizations announced their readiness to participate in distribution and reviving water-rate affairs and other related activities it the Gilan committee approved it. This announces was made by considering higher technical expert capacity related to agricultural and watering activity.

But common committee emphasized on this statement that according to government policy related to bulk water delivery to farmers and establishing *WUA* councils the aim at transferring exploiting management from the watery network to these councils was formation at these councils by farmers guide exploiters with agriculture' JAHAD 'ministry and water-delivery by regional water, and the members of these canonicity should be only farmers.

So, the members of agriculture engineer system were not able to have a key role in these council, become they were not farmers.

At last it was suggested that for examining lawful ways of attracting expert participation, a draft of *WUA* Cooperative article of association be sent to the natural resources org.

The following are summarization at suggested way in this area:

1. The members of engineering system, should become the members at *WUA*.
2. The suitable contract company should be established which participates in the tender at constructing affairs and keeping watering network so that it could contest with exploiting company.
3. By the help of farmers of region, they form the new Cooperative.

The thought at forming new Cooperative and contract companies were applicable, but very long time was needed for its results and the need at company to plans, made. That end, toward membership at management system experts inheritable. So the committee suggested an other condition for extending contract with Cooperatives, to they agreement, that is, absorption an unemployed waiting engineers graduate by each company.

All we have said were in fact preparations for improving our work and was assessment for a reasonable future of Gilan *WUA* Cooperative. But watering season was not a suitable time for preparation and innovation.

Watering in Gilan is a place for getting experience and operation.

The members of watering offices in Fomanat *WUA* under-covered Cooperative region (managers, office heads-experts – technical and…) saw the result of their many years efforts was subject to defeat, so for saving Fomanat watering, they attempted a lot and made a tire some reparation in under-covered region.

In receiving season, the Cooperative companies for not having enough number, vehicle and the most important one, lack of complete satisfaction. In making contract and proposing the existence of obligation on the part if authorities in accepting the responsibility, confronted with problems for distributing bills from beginning. There was no sign of movement and preparation on the part of Cooperatives for acquiring watering affairs and solving technical problems and in this regard the affairs related to purchasing Gilan tea was transferred to Cooperatives by government-board that completely cut their relation with watering affair.

This issue first caused the lack of water-rate bills distribution in the due time, and secondly censed the lack of getting bills by farmers. The framers did not take this issue serious because they supposed that watering duties and the solution of their problems were practically on the shoulder of Fomanat watering offices, because they didn't trust on their actions and on the other hand, they supposed Cooperation's.

Without any lever efficiency in receiving affair. Cooperatives for unsuitable distribution and weak operation in deposit part in recent years were not trustable any more. Severe deduction in the receiving percent in Fall 1384 motivated the watering office colleagues to not only report this issue to higher ranked authorities, but also they themselves perform directly and by issuing warning letter and serious and round-hour presence in village to improve this trend.

This movement to some extent was successful, but because of ambiguity of company policies in this regard and also because at reduction in personnel over-time average and other received advantages of these in comparison with other ruined the motivation.

Recent eleven-year statistics at Fomanat water-rate in comparison with other watering affairs, clearly shows that the receiving difference of these affairs with others before the foundation of Cooperatives, was always between 5-7 percent and was even more but in the year 83 has reached to negative difference and a reduction higher than 20%.

According to Fomanat watering affairs there was a probability of reduction in receiving amount even worse than 2004 variably, Fomanat watering affairs asked for a receiving in contrast with Cooperatives at the level of superior management of exploiting company.

The written documents at the end of watering suggest that superior managers of exploiting company inspire of all its interest in employer's opinions and ideas in respect to performing *WUA* Cooperative plan, for defending exploiting company personals were forced to report samples of lack of practical operations of rural Cooperative commitment to affiliated authorities.

TWO YEAR ESTABLISHMENT REPORT OF GILAN WUA COUNCILS

Now, we reach at a point of making decision, we have not any time and place to pass this road again. Now we are at the point in which to fallow the famous management science in the world, so we should seek ways and tools for purifying and evaluating the under-test method.

One thing was not paid attention during all the processes in Gilan: to what extent we are doing well? That is, Do the performed actions have the predetermined results? and this question makes another one.

What was the possible results of performing management transfer plan in Gilan? With regard to the ideas of many great masters in management transfer who believed that we can not plan completely the reformation of governmental basis reconstruction and farming organization enhancement, before performing governmental forces involved in Gilan watering believed that evaluation key factors before operation prevent many existing tensions. The framework of these questions could be like following items:

- ◇ Do the people in charge of the most modern watering network of Gilan, have enough technical knowledge about watering?
- ◇ Which role do the services transferred to them have in improving network goals? (for example network repayment from the end of watering to the

beginning of the next year watering is a main goal and there is no atmosphere for time consumption and trial-error.

- ◇ To which percent do the new councils, profit from experts capability and skill?
- ◇ Do the councils have the ability to confront possible problems? Do we have any plan and prediction for support them?
- ◇ How is the acceptance of region (*WUA* and farmers) toward these councils?

Is it positive or not? To clarify the activity of council, how much could we profit from natives operation? What is the situation of network we transferred to councils with respect to efficiency and need to repair and reconstruction.

And then: to which goal do we intend to reach?

- ◇ Increasing improvement in water consumption.
- ◇ Achieving better results in collection affair.
- ◇ Achieving better results in keeping and exploiting network and buildings.
- ◇ Extending water and draining network.
- ◇ Decreasing government responsibility through formation of non-governmental organization.

For every individual goal mentioned here, investment is a key factor; other factors are need to longtime study and evaluating possible ways especially consistent with ecological condition of region.

By all these preparations for any new plan we should consider a present of risk. By transferring some automatics to councils, government organization tries to reduce their financial participation in exploiting and keeping affairs now by this presupposition that *WUA* couldn't reach the predetermined goals (of course if this goal is determined before). Does the government organization have the ability to accept the financial bur don of this defeat without imposing it to their personal?

After identifying the certain ways for true and unchallengeable transmission, Identify the people who are involved in this change is required to continuing and improving the future plan situation.

The major and famous poles in this change are more important them others:

- Current watching administrators (government forces)
- Future/ subsequent network administers farmers and formed councils by notice forces.

For making constancy in the output of there Cooperative and getting positive results for this transference should act in a way that make a spiritual balance and job relation between the recent form and subsquad network managers. Because this change of any kind is successful when it occurs gradually.

In this transference, the duties are required to be transferred to council managers in the best way, on the other hard for transfer of there experiences we should get help from waiting pioneer's experiences and knowledge or from young educated and expensed forces.

And there members are considered as the government council members at resent. If this substitution and members at present.

if we don't have logical and true plan, the first crisis is the challenges that will occur among the carafe network managers. Because this group against losing there job apportioning and their future they reveal a negative reaction and in this knowledge and experience transfers they don't Cooperative as required.

So for solving this problem, first we should pay attention to change in the way of thinking.

Attaching the opponents Cooperation of this plan with this present skill and the foundation of team works from the beginning of watering season in which a group of exploiting company expects work in the affaires in line with Cooperative, is one of ways to convey the opponents the government organization in this plan.

This issue helps the group to work better in transferee information and louts they try for the important of a single goal so they perform convergent.

In the next step, we should prevent from the enlarging of governmental organization body and the young dependency on the governmental organization (increase in the number of opponents).

The number of governmental expects gradually decrease as the time pusses and they reach the age of retiring. In a suitable substitution. We can prepare the situation in a way that the new forms install of entering to the government place enter the province watering cycle and perform these duties beside the Cooperative forces. Profusions and the way of relation of them two groups with each other is only of the topic for which we should think about from now on.

CONCLUSION

Gilan *WUA* Cooperatives, in the 3rd years contract, didn't receive any new. Important by the governmental organization. But the Cooperative themselves didn't show interest in making contract. The number of these Cooperatives reached 6 from 31. And till the and of December of 2007 this number were nullified for the seven weakness in receiving and not doing its duties according contract with exploiting company.

So, Gilan should show all the achieved results from forming councils in past 3 teem and considered all the aspects and start again.

We should not forget that Gilan farmers know the value of watering and according to historical documents if was are of the pioneers in technical watering all over the country it should only match the foundation needs of farmers cultured experience with social and propagated this thought among farmers that they themselves are the original owners of Gilan crating system. In this meetings that were held at the beginning of founding this *WUA* councils we mutation that farmers hesitate about all new plans province. So at should consider the time for to rub of this negative orientation nowadays the emphasis of world to increase the function monitions for accepting responsibilities. This issue is ever more important than their training considering and training network consumers are simply just as a consumer because their duties has been governmental and thay are strange with the complexion of grew management states.

Farmer is sensitive to the rate of receiving water as according to has portion and when we take step to train the we shad be equipped with water measurement systems. we should consider more credit for reconstruction the network.

When the trust between governmental and local forces has been formed gradually we can observe that farmer go beggared the water conduct and racings water-rate and because informed in planning and canal construction.

We hop the feature of this council in our ever-green lands. Although we acquired training and experience in this trial and error.

But what we should keep in our mined is the complicated condition of water in the world and in our country till 2003 AD the amount of water collection for watering in devolving countries with increase 14%.

If Gilan as a special geographic condition in the semi dry country Iran can reach to the high figure in the connection water star up to about 10 years, it is a guarantee for the price of rice, tea and olive in Iran… and this is possible to improve the huge management.

REFERENCE:

1. 1.khuzestan regional committee on irrigation and drainage. jan. 6&7, 2004. *proceedings of the third seminar pressurized irrigation system.*
2. iranion National Committee on Irrigation and Drainage (IRNCID). *January 1999. iranion management transfer*.
3. iranion National Committee on Irrigation and Drainage (IRNCID). 1997. *Locally managed Irrigation system*.
4. iranion National Committee on Irrigation and Drainage (IRNCID). 2001. *Man and Water in Iran*.

PIM/IMT: CONDITIONS OF SUCCESS IN LARGE CANAL SYSTEMS OF INDIA

Niranjan Pant[1]

ABSTRACT

Large canal systems in India contain nearly 40 percent of country's total irrigation potential of 94 million ha, a substantial part of which, remains unutilised. The main reason behind the lack of utilisation is the ill maintenance of irrigation systems, particularly micro systems at lower levels and those at the farm level. Faced on the one hand, by the near collapse of such irrigation systems and on the other, utter financial crunch, administrators are susceptible to donors like World Bank and Asian Development Bank, who are currently coming forward with funds with the conditionality of PIM. Coupled with this alluring prospect is India's experience of the last three decades with the concept of PIM. The scenario that exists in India provides both an opportunity and challenge. The paper based on the author's experience as a researcher/consultant cutting across country's cultural and geographical boundaries, short lists conditions of success of PIM along with a close scrutiny and analysis of the impediments that impinge on its path. Although the examination takes into consideration all the Indian states where PIM is being implemented, a lot of illustrations have been drawn from the state of Maharashtra mainly because its strategy appears to be the most pragmatic and sustainable. In conclusion, it could be safely said that that although the conditions of success and the impediments discussed in this paper are in the context of India, the same are applicable to all countries that are aspiring to achieve success in this respect.

1- Director, Centre for Development Studies, B- 2/68, Sector 'F', Jankipuram, Lucknow-226021, INDIA. E-mail: pantn@sify.com. Ph: 91-522-2361339/ 91-522-4007645

Abbreviations and Glossary

AP	Andhra Pradesh
CADA	Command Area Development Agency
CCA	Cultural Command Area
Chak	Land Holding
DSC	Development Support Centre
FMIS	Farmers Managed Irrigation Systems
GOI	Government of India
GOM	Government of Maharastra
IDE	Irrigation Department
IMT	Irrigation Mangement Transfer
Kharif	Wet season (June – October)
MOU	Memorandum of Understanding
PM	Madhya Pradesh
MOWR	Ministry of Water Resources
NGO	Non Government Organization
Osrabandi	Fixation of Turn
PACT	Project Activity Core Team
PIM	Participatory Irrigation management
Rabi	Dry Season (October-March)
SOPPECOM	Society for Promotion of Participatory Ecosystem Management
Thok	Cluster/Group of Land Holdings
UPID	Uttar Pradesh Irriagation Department
UPWSRP	Uttar Pradesh Water Sector Restructuring Project
USAID	United States Agency for International Development
Zaid	Summer Season (April- June)

INTRODUCTION

The British colonial rulers were not oblivious to the role of local community in the operation of works for irrigation. On the contrary, a long series of 19th century British administrators saw local organisations as central to the success of virtually all irrigation works. But they also saw local community within a distinctive framework, which had critical implications for the future of irrigation (Gilmartin 1999, 238). This is no coincidence that the Northern Canal and Drainage Act, 1873 conferred the rights of distribution of water with beneficiaries who were supposed to fix and apportion their shares of water by mutual agreements. Only in case of disputes were the beneficiaries required to apply to the Executive Engineer for an *Osrabandi.* As far back as the year 1890, cultivators started submitting written mutual agreements to the Executive Engineers. These agreements were for sharing of water, on a day-wise basis, amongst them. Three types of *Osrabandi,* namely, c*hak-wise*, *thok-wise* and village-wise could be prepared according to the convenience of cultivators. Even today the *chak-wise osrabandi* is in vogue in the old canals of western parts of Uttar Pradesh (Pant and Verma 1983, 26).

PRESENT SCENARIO

Large canal systems in India contain nearly 40 percent of country's total irrigation potential of 94 million ha. The staggering rise in the cost of creation of irrigation potential can be gauged by the fact that in comparative nominal terms, the public sector outlay has risen from an average of Rs.[1] 900 million per annum during the First Plan to over Rs. 650,000 million in the Eighth Plan (Vaidyanathan, 1999, 56-58). Despite the overwhelming increase in the outlay all these years, the management of canals has remained highly inefficient leading to an ever-increasing gap between the created potential and its utilization. The main reason behind the lack of utilisation of irrigation potential is the ill maintenance of irrigation systems, particularly micro systems at lower levels and those at the farm level (GOI 2003, 676-77). Faced on the one hand, by the near collapse of such irrigation systems and on the other, non-availability of funds leading to a severe financial crunch, the answer is being found in PIM. International donors like the World Bank, Asian Development Bank and other donor agencies are currently coming forward with funds with the conditionality of PIM/IMT. Coupled with this alluring prospect is India's experience of last three decades in respect of PIM/IMT[2].

EVOLUTION OF PIM

During the last three decades, the concept of participatory irrigation management (PIM) in India has passed through four distinct phases. Starting from around 1975 and for about a decade until 1985, the emphasis initially was on creating outlet based water user

---

1- Rs. stands for the Indian currency rupees and one US $ is equal to about Rs. 45.

2- The man behind the idea of the present-day PIM and irrigation co-operatives in Maharashtra was the legendary civil engineer M. Visvesvaraya, who as early as 1902-03 had advocated establishment of such co-operatives in respect of Khadakwasla canals while working as Assistant Engineer in the then Bombay state. The two earliest water user co-operatives were established in the 1930s. The first one, Saswad Mali Society, was established in 1932 in Pune district. The second, Samvastar Vibhag Water Supply Co-operative Society was established in 1936 in Ahmednagar district.

organisations. Later on researches were conducted leading to support for PIM as a pragmatic solution for equitable distribution of water among the irrigators, maintenance of water conveyance micro structures and resolution of conflicts amongst the water users. During the second phase (1985-90), the emphasis shifted to experimentation with PIM. During this period, MOWR, GOI, World Bank and USAID aided and assisted in the establishments of pilots, while NGO's played a catalytic role in mobilizing farmers and sustaining the pilots. The third phase starting from early 1990s has seen the emergence and propagation of the idea of hand over/turn over of management of irrigation systems/ sub-systems (distributaries/minors) to the irrigating farmers. This was started in Maharashtra in the early 90s (Pant 1999), followed with India's first FMIS Act in AP in 1997. At least six states (AP, MP, Chattisgarh[1], Rajasthan Karnataka and Orissa) have now enacted legislation that makes PIM a statutory requirement to get access to irrigation water. WUAs have grown up in almost all other states and many of the states are in the process of enactment of similar legislation. The fourth phase starting from 1997 marks the emergence of donor funding for restructuring India's irrigation sector with PIM/IMT as a core programme. The scenario that exists in India provides both an opportunity and challenge.

The two PIM models available are Andhra model and Maharashtra model. The former represents a top down approach where an Act was passed in a relatively short time and a large number of WUAs were established swiftly. However, the autonomy and sustainability of WUAs is being questioned both by academics and activists (SOPPECOM, 2004). On the other hand, there is Maharashtra, where establishment of WUAs has been going on for over last 15 years and the Act had not been passed so far because the State Government is closely examining all the pros and cons.

CONDITIONS OF SUCCESS

This paper, based on author's experience of last thirty years as a researcher/consultant in respect of PIM cutting across country's cultural and geographical boundaries, short lists conditions of success of PIM along with a close scrutiny and analysis of the impediments on the path of PIM/IMT. Although the following review takes into consideration all the Indian states where PIM is being implemented, a lot of illustrations have been drawn from the state of Maharashtra on account of two reasons. First, Maharashtra strategy appears to be the most sustainable; and second, the author has studied the Maharashtra experience in far greater detail than any other state (Pant, 2000). The sequencing of conditions of success and later that of impediments have been done in terms of their importance and/or logical occurrence in the process PIM/IMT.

CRITICALNESS OF CANAL WATER

The most important factor inducing farmers to come together and work for the common good has been found to be the critical necessity of canal water for the comfortable living or even survival of the farmers. If farmers believe that by coming together and forming a WUA they would enhance and optimise their water supply, they would go out of their way and work physically by offering volunteer labour, paid labour or by contributing

1- The state has retained the PIM Act that was passed in 1999 when it was part of MP machinery to do earthen work for improving their water delivery. In a large number of cases, WUAs located towards the tail of the system were hardly getting any water. In such cases, the farmers contributed their voluntary labour to construct several check dams across the streams flowing through the commands of WUAs to improve the ground water level and to apply conjunctive use of ground and surface water. In fact, in some cases, the WUAs had evolved a very appropriate system of charging for the use of well water from their members. In one case, farmers had to launch a movement and subsequently 400-500 farmers gathered together to force the ID to sign the MOU and hand over the management to the WUA. In another case, the WUA dug a large and deep well in the village temple land by voluntary contributions to save *kharif* excess water to utilise during the *rabi* season. All these illustrations reinforce the point that if canal water is critical for the lives of farmers and they do not have any other feasible and economically viable means, they would come forward, form a WUA and then try to sustain it (Pant, 2000).

RIGHT KIND OF MULTIPLE LOCAL LEADERSHIP

One common feature of all the successful WUAs was found to be the right kind of local leadership. By right kind, we do not mean “selfless commitment”. In most of the cases, it was found that the local leadership had a vested interest in the WUAs. It was often found that their average land holdings were higher compared to the average land holdings of the members. By right kind, we mean such rural elites who had local influence, high socio-economic status but who had a propensity to come forward to work for a common good where they could derive advantage for themselves also in some common good. The type of leadership who work in harmony with others without jeopardising the interest of others. These were the local leaders who believed in the maxim, “when I serve others’ interest, I serve my interest also because my interest is a part and parcel of others” interest.” According to them it is a matter of coincidence that their interest (land holdings) happened to be bigger (Pant, 1986 and 2000).

Local organizations, when they are initiated by committee members or local leaders, have greater chances of sustainability. Further, those WUAs, which depend on multiple local leaders, are likely to have greater sustainability in comparison to organizations, which depend on an individual leader. This is the differentiating feature between institutionalization and non-institutionalization of the leadership and in the latter case the organization collapses with the removal of the leader from the scene (Pant and Pant, 1996).

PROVISION OF INCENTIVES

One conclusion that comes out conclusively from our various studies, whether of Bihar (Pant and Verma, 1983) or of Maharashtra (Pant, 2000), is that incentives must be built around the programme of PIM/IMT if it has to succeed at least in the initial stage. As the organization grows and stabilises, such incentives can be reduced and ultimately withdrawn completely.

The IMT programmes in India involve a number of incentives, which attracts farmers towards establishing WUAs. In case of Maharashtra, for instance, a number of concessions/incentives are available for the IMT programme. First, there is a management grant @ Rs. 100 per ha for the first and the second years and @ Rs. 75 per ha for the third year. Since the 50% matching grant from GOI under this component is available only for the CADA projects, in case of non-CADA projects the matching portion is also provided by the GOM.[1] Second, GOM provides maintenance grants to WUAs @ of Rs.20 per ha per year. Third, 5% concession is given to WUAs on timely payment of water charges. Fourth, the WUAs are provided water on a volumetric basis, which comes much cheaper than water calculated on area basis. Fifth, the WUAs do not have to face any crop restriction. The WUAs are given an allocated quota of water and within this quota they can grow any crop they like. Sixth, IMT involves rehabilitation of the irrigation sub-system to its designed level or at least to a workable operation level. The rehabilitation work involves repairs of about Rs. 800 to 1000 thousand per WUA, which goes along with IMT. Seventh, non-members can be charged 30% more than members' water charges.

One of the reasons why there is so much enthusiasm among farmers for IMT in Maharashtra is that, against 533 WUAs where IMT has taken place, there are 1939 WUAs in various stages of completion of IMT.

Close Involvement of the ID Officials

Based on past research it has been found that the most successful WUAs were the ones where greater interaction and most frequent contacts between the ID officials and WUAs were obtained. WUAs have succeeded and sustained only in such projects where top irrigation bureaucracy took a keen interest and the field staff genuinely worked in close collaboration with farmers. In the initial stage, WUAs need assistance for registration, accounting system, and development of internal structures that are conducive to high level participation. In cases where this close interaction and collaboration was lacking and the WUA was created to fulfil the target requirement, the association collapsed as soon as management subsidy ended. Interventions by senior bureaucracy of ID in meeting the genuine demands helps in strengthening WUAs. On the contrary, hollow promises reduce the legitimacy of the WUA considerably and the beneficiary farmers tend to lose faith in the existence of WUA. Legitimacy is different from the legality and it need not follow legality. An important element in the acquisition of legitimacy was found to be the extent to which the ID officials met the genuine demands of the farmers. If the repeated complaints of a WUA, say about an inadequate and irregular supply of water do not rectify the position, the water users lose interest and the WUAs tends to become defunct. On the contrary, if the genuine demands of the WUA are met, it grows, stabilises/institutionalises and becomes a role model WUA. (Pant, 1983, 1993, 1995 and 2000).

Wherever PIM experiment has succeeded, lot of care has been taken in the placement of staff in critical positions. As a first step, all such officials (most senior to most junior) who have commitment to PIM and hold sympathetic attitude to the beneficiary farmers in general and on the viability of the WUA as an institution in particular, must be

1- As per the financing pattern w.e.f. 01.04.1996 a functional grant in lieu of management subsidy is to be given to the WUAs @ of Rs. 500 per ha. It is to be shared between the GOI, the state Government and the WUAs in the proportion of Rs.225: 225:50 respectively.

identified at various levels of bureaucracy. Once such officials are identified, they can then be short listed and placed in strategic positions (Pant, 2006).

DEMOCRATIC FUNCTIONING

One of the preconditions that need to be set for the registration of WUAs is that 51% of the beneficiaries and beneficiaries with 51% of the land in the CCA must be agreeable to form the WUA. Such a condition may prohibit a few big farmers holding 51% of CCA to form WUAs for their vested interest disregarding the interest of small and marginal farmers.

As regards other components of legitimate democratic functioning, these include periodic elections, defined rights, including safeguards to protect the interests of small farmers and women, a written constitution and bylaws, and regular meetings of the executive and the general body. Of these the foremost is a written constitution with a general body and an executive committee and the regulative mechanism of the same. The important question is to what extent the WUAs observe these requirements in a true spirit. In all cases where the functioning such WUAs were successful and sustainable, it was found that the proceedings were duly recorded, elections took place at regular intervals and, in a large majority of cases, the minutes/decisions of the organs of WUAs were typed/printed and widely circulated. Although elections often extended the continuation in office of the same old guards who formed the WUAs, membership circulated among a variety of individuals. In some cases, a complete overhauling of the executive committee also took place (Pant 2000).

THE MEMORANDUM OF UNDERSTANDING (MOU)

The following two points must be reflected in the MOU. One, that farmers would get rights in water allocation through the agreement and an assurance in getting a predetermined quantity of water at a predetermined time. Two that they would get right of information and thereby hope to get, on demand, the information related to water availability.

In Maharashtra the agreement/MOU between the WUA and the ID is the instrument, which secures provision of water quota to the WUA season-wise. This quota varies from one WUA to another. In some cases the quota is only for *rabi* and *kharif*, while in others it is spread across the three seasons, including the *zaid* weather. However, when the quantity of water in reservoir itself was below the normal, the water quota of the WUA was accordingly reduced. This reduction in abnormal circumstances is provided for in the MOU of all WUAs

The ID provides the agreed amount of water at the minor head, where measuring devices are installed before the MOU. However the WUAs have to often accept the take-over of the systems even though the rehabilitation work is incomplete. In reality, a reasonably sound physical system seems to be acceptable to farmers. This means the system with a measuring device at the off-taking point of the minor, selective lining and even 50 to 60 per cent of designed discharge is considered as a comparatively sound physical system. Majority of the successful WUAs in Maharashtra have this type of physical system (Pant, 2000).

ELIMINATION OF IMPEDIMENTS

Emanating from the Andhra and Maharashtra models are two broad strategies adopted in the implementation of PIM in India. The AP and MP experience concentrates on a rapid and extensive introduction of PIM through legislative measures. In contrast, the Maharashtra and Gujarat experience mainly exemplifies the motivational strategy. The emphasis is on first building up awareness, creating motivation and then introducing PIM. These strategies could also be contrasted as top-down and bottom-up strategies respectively. In either, care needs to be taken to eliminate all such obstacles that jeopardize the successful implementation of the PIM concept.

ABSENCE OF A CLEAR-CUT POLICY AND VISION STATEMENT

Even states that have enacted legislation have not come out with a clear-cut policy statement that governments have decided to hand over the management of irrigation systems at the minor/distributory level to the WUAs in a phased manner and within a fixed time frame. Consequently, the government officials do not attach required importance to the work concerning forming and sustaining WUAs. The irrigation bureaucracy, meanwhile, works with a rigid mindset. The officials think that it is not their work and that an extra and unnecessary task has been imposed on them. They take up the work under the compulsion of targets. Further, the commitment and priority of higher ups for this kind of work goes on changing and consequently, adhocism is the reigning principle.

Building of WUAs is a long drawn social process and cannot be done by issuing orders. Experience shows that after the system is turned over, the officials of ID feel that their role is over. Ideally, with the completion of the turnover, the role of the ID changes from administrative authorities to friends/guide providing assistance and support to WUAs. The associations can sustain only if they receive continued technical assistance and co-operation from ID officials until they are self-sufficient. It is therefore necessary that each state government should come out with a clear-cut vision statement along with a clear mandate and milestones for making WUAs autonomous. This would require changes both at the project and WUA levels (DSC, 2006, 20).

DELAYS IN COMPLETING IMT REQUIREMENTS

The stage of IMT comes after a number of preliminary requirements are fulfilled. These include registration of WUA, joint inspection of the system to identify the operational deficiencies in the system, signing of MOU, and hydraulic testing of the system. Once registration has been completed, the joint inspection is not carried in time and it gets delayed unnecessarily. Even when it takes place, the presence of the representatives of WUAs in this joint inspection is notional. They are not allowed to make their views incorporated in the joint inspection report. Their views are disregarded on grounds that the same are non-technical. Even when the estimates of rehabilitation works are prepared, the same are not shown to the WUA representatives. Again estimates are not prepared in time. The general tendency in preparing the estimates is to put lot of lining work, which is unnecessary and is incorporated mainly to get the work cost inflated.

Once the execution of rehabilitation work starts, it is not done properly, particularly in the work relating to embankments and masonry structures. Finally, the hydraulic testing of the system is not done before handing over the system to the WUA. As per agreement, this is required to be done before the hand over. In the absence of testing, WUA does not know the water conveyance losses and water conveyance efficiencies. It is therefore necessary that that time bound work plans are prepared, discussed and sanctioned and the concerned officers should be held responsible and punished if time schedule is not observed.

DELAY IN REHABILITATION WORKS

The main obstacle in effecting IMT is the rehabilitation of the minor/distributory. This is the main delay between the registration and IMT and this delay was found to be varying between 15 and 27 months. This was because of delay in carrying out rehabilitation of minors in terms of deficiencies found at the time of the joint inspection. In Maharashtra, up to March 2004, there were 533 functioning WUAs encompassing 158 thousand ha of CCA. As against this, there were 1939 societies containing a CCA of about 639 thousand ha waiting for IMT (Soppecom, 2004). The most damaging impact of this delay is that farmers lose all their enthusiasm and things are again back to square one.

It is therefore suggested that state governments should open a new ‘budget head’ in the annual budget and allot grants specifically for the rehabilitation works proposed under each irrigation project and the same should be clearly shown, as such, in the annual budget separately for each project officer. The project officer will then be responsible for demanding and spending of these sanctioned grants specifically for the purpose.

LACK OF TRANSPARENCY

One of the biggest impediments in the successful execution of IMT programme is the lack of openness in preparation of estimates and the execution of work. Therefore, a copy of the rehabilitation estimates prepared by the ID must be given to the WUAs for their comments. It is further suggested that the quality of repair work done by the contractors appointed by the ID must be supervised and certified as satisfactory by the representatives of the WUAs and only after this is done payment be made to contractors.

TARGET VERSUS SUSTAINABILITY

Mere targets are not enough; field staff’s passion, commitment, devotion and faith in the IMT programme are necessary. Creating collective organisations for common good is a formidable task. It requires a great deal of patience to persuade, encourage and guide the farmers in the process of formation of WUAs. A few meetings with farmers are not enough. Initially 2-3 days duration day and night camps followed by a series of meetings are necessary. (Pant, 2006).

In situations where a host country or a state of that country where a donor assisted project is being implemented is not committed to the concept of PIM then donor assistance becomes more a curse than an opportunity. A case in point is the World Bank funded UPWSRP in UP In this Project the implementing agency did not do anything for over three years for the establishment of WUAs and then within a span of couple of months registration and handing over/agreements (MOU) for maintenance to WUAs was done for 416 WUAs envisaged to be established. Side by side, against all norms and democratic procedures and autonomy, the Junior Engineer of ID was made the Secretary of the WUA and a signatory of its bank account. Further, the Chairman of the PACT had claimed after one day's field visit, "that the state is undergoing a silent revolution paving the way to farmers for equitable distribution of irrigation water through minors managed by Water Users Associations (WUAs)". This was done as the apparent focus of program was to attain targets of rapid establishment of WUAs in the project commands without adequate preparation and was bound to turn out to be counter-productive. The model of WUA, which such provisions create, may not be in line with the sustainability and in fact, the institution could be manipulated to remain a creature of UPID and thus quickly fail as a sustainable institution. While there is an overt state policy on participatory irrigation management, it seems that this policy has not been covertly accepted and internalised and therefore does not coincide with agreed objectives and obligations under the World Bank funded UPWSRP. Another problem was found to be rampant corruption in execution of the PIM programme and the nexus between the NGOs, consultants and the implementing agency had become so institutionalised that it could not be broken (Pant, 2006).

LACK OF APPROPRIATE TRAINING

In order to increase the pace of implementation of PIM and attain sustainability of WUAs, it is very necessary to change the mindsets of government officials and to enthuse them with a sense of devotion and commitment to PIM/IMT program. One of the most important factors responsible for the failure of the government-initiated WUAs is the attitude of the implementing staff, towards the members of new organizations. It has often been found to be a relationship of unequals and the attitude of the staff is frequently one of superiority towards these members.

In case of farmers, it would require orienting them to irrigation in a collective way through group action and joint management with ID ultimately developing management capability both in terms of sub-system management and organizational management of WUAs. In respect of WUAs, it is found that they are not fully aware about their rights and responsibilities. Further, they lack guidance about their powers to fix water rates, recovery of management costs, running rates and for enforcing discipline in taking water.

LACK OF PROPER MONITORING AND EVALUATION

Although issues for evaluation are often spelled out, no specific parameters for evaluation are identified. Where parameters are mentioned, no precise measurements are formulated and thus no scoreboards are prepared for monitoring the performance of WUAs. Where detailed manuals are prepared for this purpose, the check list is so detailed that it is not feasible to use such check lists for a quick and quantifiable assessment by teams of officials, consultants, researchers etc. who make short field visits to assess the functioning of WUAs. Keeping all these in mind, an attempt has been made to prepare a simple and easily workable format for assessing the performance of WUAs in a comparative and quantifiable manner (annexure 1). The format may be further improved after field visit experiences.

In conclusion, it could be safely said that that although the discussion in this paper relates to the conditions of success and the impediments to PIM/IMT in the context of India, there are lessons for all countries striving to ensure collective governance of the irrigation systems by the users themselves.

Annexure 1

Format For Assessing WUA Performance

Particulars	Level of Performance				
	Excellent	Good	Average	Poor	V Poor
Weightage points	(5)	(4)	(3)	(2)	(1)
Activities					
A. Level of Participation					
Leadership capability					
Members awareness about WUA status					
Productive meetings					
Voluntary physical/labour contribution					
Voluntary financial contribution					
Social Audit/ Transparency					
B. Operation and Management					
Removal of silt and weeds					
Repairs/maintenance of structure					
Protection of structure					
Dispute management					
C. Water Management					
Adequate and timely water supply					
Information about water distribution					
Efforts to save water					
D. Financial Management					
Fund generation					
Utilisation of maintenance and operation fund					
Recovery of irrigation fees (when applicable)					
Financial audit					
E. Organizational Linkage					
Horizontal linkages with other WUAs					
Vertical linkages					
Information and communication					
Discussion with competent authority					

Notes: For the purposes of quantifying WUA's, Level of performance following weightage points would be used = 5 (excellent), 4 (good), 3 (average), 2 (poor) and 1(very poor). Since 21 parameters have in used in the socio-metric scale, the performance will be measured between Most Excellent (105 points) and Extremely poor (21 points).

REFRENCES

1. DSC (Development Support Centre). 2006(January 20-21). Proceedings of Regional Workshop on PIM, Ahmedabad
2. Gilmartin David. 1999. “The Irrigation Public: The State and Local Management in Colonial Irrigation” in State, Society And the Environment in South Asia edited by Stig Toft Madse, Curzon Press, U.K.
3. GOI (Government of India) 2003. Five Year Plan 2002-2007, Vol.2: Sect oral Policies and Programs. Planning Commission, New Delhi.
4. Pant N and R.K. Verma. 1983.Farmers' Organization and Irrigation Management (with R.K. Verma), Ashish Publishing House, New Delhi.
5. Pant N 1986. Farmers' Organization in Large Irrigation Projects, Economic and Political Weekly, 21, 52.
6. Pant N 1993. "Performance of the World Bank Tubewells in India" in Ground Water Irrigation and the Rural Poor - Options for Development in the Gangetic Basin, edited by Friedrich Kahnert and Gilbert Levine, The World Bank, Washington, D.C.
7. Pant N 1995."Turnover of Public Tubewells in Uttar Pradesh: Case study of a successful cooperative Society" in Irrigation Management Transfer, edited by S. H. Johnson, D. L. Vermillion and J. A. Sagarey, IIMI, FAO. Rome.
8. Pant N. and Lalita.Pant 1996."Development of local structures" in Participatory Approaches to Sustainable Rural Development, edited by K. Vijayragvan and others, Indian Potash Limited, New Delhi.
9. Pant N 1999. Impact of Irrigation Management Transfer in Maharashtra – An Assessment, Economic and Political Weekly, 34, 13.
10. Pant N 2000 (March). Impediments in Participatory Irrigation Management: Case Studies from Maharashtra, Centre For Development Studies, Lucknow.
11. Pant N 2006 (May). Personal Observation on PIM, Centre For Development Studies, Lucknow.
12. SOPPECOM 2004. Participatory Irrigation Management: An Overview of Issues and the Way Ahead, Pune.
13. Vaidyanathan A 1999. Water Resource Management: Institutions And Irrigation Development In India, Oxford University Press

ADVANCES OF THE IRRIGATION MANAGEMENT TRANSFER IN THE LARGE-SCALE IRRIGATION SCHEMES IN MEXICO

Paula Silva Ochoa[1] and Carlos Garces-Restrepo[2]

ABSTRACT

Mexico is a world leading country in relation to Irrigation reform. An Irrigation Management Transfer of the large-scale irrigation schemes to Water Users Associations, locally known as Irrigation Districts, took place in Mexico since 1989. Until today, the IMT program has transferred irrigation infrastructure, below the main canal level, commanding 3.273 Mha to around 474,000 water users organized into 474 Civil Associations (or *Modulos*). Likewise, at main canal level 13 federations of water users associations known as Societies with limited Liability (or SRL) have been established so far. The main objectives of IMT were, among others: to ensure the sustainability of the irrigation districts, to reduce the financial burden on the government, to pass the responsibility for O&M to the users, to increase efficiency in the use of water, to improve and sustain system performance, and to reduce the number of public employees in the irrigation districts.

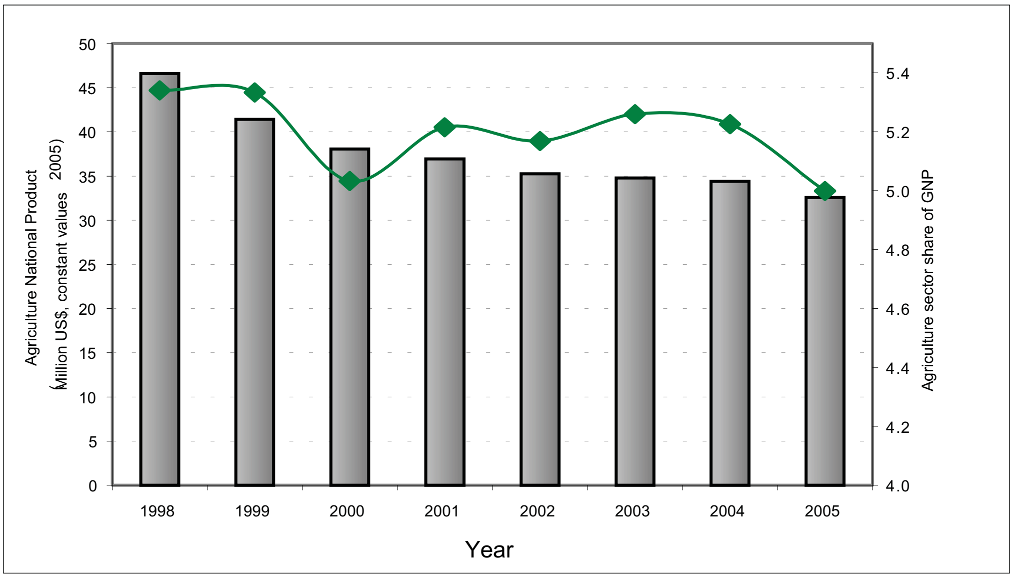
In early 2001, FAO through its AGLW Service and the International Network on Participatory Irrigation Management (INPIM) joined forces to document on-going worldwide efforts on irrigation water reforms. An international e-conference event was held which, included the IMT Mexican case. In this document, is presented an updated version of the review of the IMT program in Mexico making especial emphasis on the actual advances and outcomes, impacts and lessons learned. Results show that the irrigation cost has increased for farmers and decreased for government, efficiency of fee collection has improved in most of the cases, and quality of maintenance has also improved. However equity of water delivery remains unchanged as well as productivity since the Gross Value per Production has a decreasing trend and improvements on irrigation efficiency and yields have a very narrow margin.

1- Hydraulic Engineer, Water Resources consultant. 425 West Beech St., San Diego, CA. 92101 USA. Tel. +1 (619) 702 7893, e-mail: polsil8a@gmail.com
2- IPTRID Program Manager,(Land and Water Development Division), FAO. Viale delle Terme di Caracalla, 00153, Rome. Italy. Tel. + 3906-570-54095. e-mail: Carlos.Garces@fao.org

INTRODUCTION[1]

THE AGRICULTURE SECTOR AND IRRIGATION SUB-SECTOR IN MEXICO

The Republic of Mexico has an area of 1.97 Million km^2 and a population fast approaching 100 Million and presents a Gross Domestic Product per capita (GNP) of US $ 6,450. The agricultural sector plays an important role in the development of the country, however, the Agricultural GDP has been experiencing, in constant values, a decreasing trend with the Agricultural share of GDP fluctuating around 5 percent, as shown in . Agricultural sector employment contribution stands now around 18 % of the economically active population, while industry has increased to 27 % and manufacturing stands at 20% (INEGI, 2002).



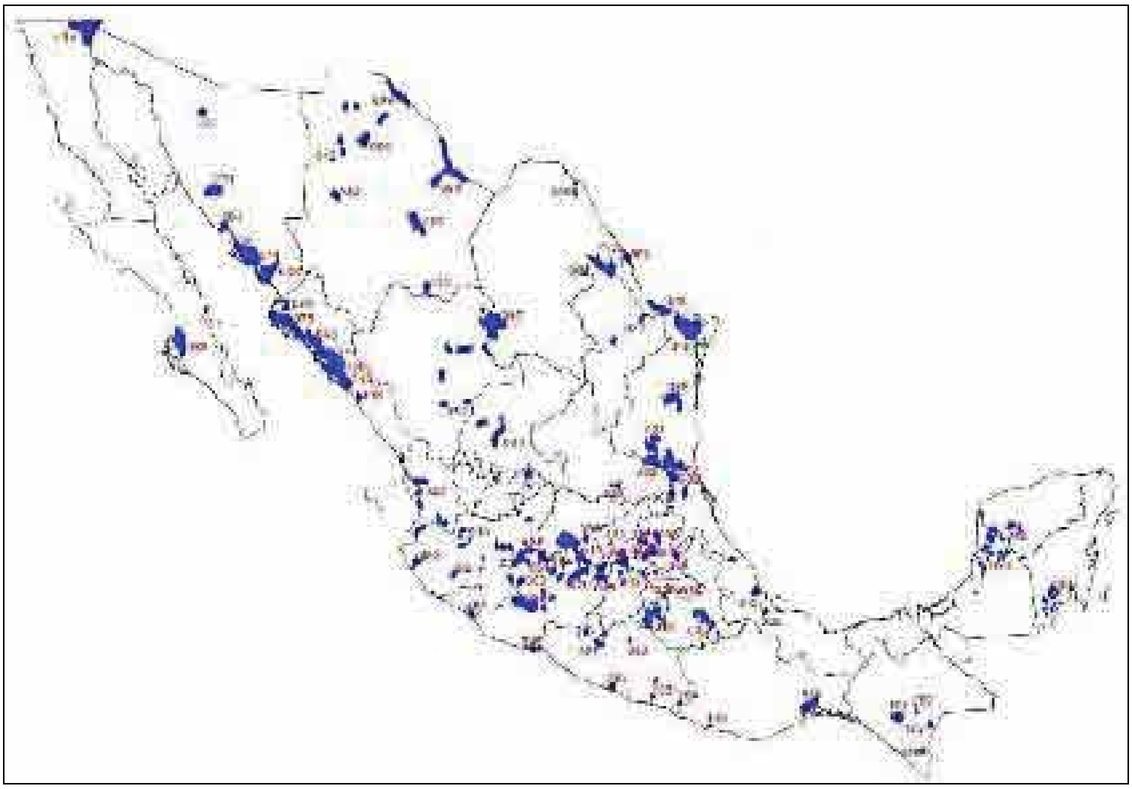
SOURCE: GDP: INEGI, Sistema de Cuenta Nacionales; CPI: BANXICO, IPC por objeto de gasto nacional, Indice general

Figure 2 Agricultural Gross Domestic Product and share

Irrigated agriculture is essential in order to obtain fully productive crops since two thirds of the country's surface is classified as arid or semi-arid. The average rainfall over 42 percent of the nation is less than 500 mm and less than a third of the country's water lies within 75% of the land area where most of the large cities, industrial facilities and irrigated land are located. Irrigated agriculture represents less than 30 percent of the total area harvested in the country, contributes about 56 percent of the total value of agricultural production and accounts for roughly 70 percent of agricultural exports. Furthermore, irrigated yields are roughly 2.5 times those of rain-fed areas. At present, of the 20 million hectares (Mha) that are under cultivation in the country, only 6.3 Mha have irrigation and drainage infrastructure. Of these, 3.5 Mha correspond to 85 to large-scale irrigation systems (see) locally known as Irrigation Districts (ID) and the rest, 2.8

1- This paper is based on Irrigation Management Transfer Case Study UPDATED: Irrigation Management Devolution in Mexico conducted by FAO. See: http://www.fao.org./landandwater/aglw/waterinstitutions/default.stm

Mha, correspond to around 39,400 small-scale irrigation systems locally known as Irrigation Units (IU), (CNA, 2005). The former initially were managed by the government and then were the subject of the Irrigation Management Transfer (IMT) program; and the latter were built with government support but have always been managed by water users.



Source: CNA, 2006.

Figure 4 Location of irrigation districts in Mexico

In terms of the water source, 76 percent of the total volume granted in concessions is use for agriculture and livestock. Out of this volume, 67 percent is captured from surface waters with the remaining from groundwater sources. and for the ID, the distribution is respectively 91 and 9 percent (CNA, 2005 and 2006). Land tenure in the irrigation sub-sector –as well as in the whole agriculture sector– is represented by two main groups: the *ejidatarios*[1] and small growers. In the IDs this relationship in terms of area is split roughly 55 to 45%, respectively. In terms of their size, the irrigation districts are distributed as follows: 32% with less than 10,000 ha; 47% between 10,001 and 50,000 ha; 11% between 50,001 and 100,000 ha; 4% between 100,001 and 200,000 ha, and 6% with areas greater than 200,001 ha.

1- *Ejidatarios* are the owners of the *ejidos* which are agrarian communities established in Mexico in the early 1930s. Land and water resources were held as common property with private usufruct rights. Today, the *Ejidos* are being titled through the Program for certification of *Ejidos* rights (PROCEDE, for spanish acronym). The Program began in late 1999 and by mid-2003 had certified and titled 81 % of *Ejidos* nationwide accounting for 65.8 million Ha and around 3.4 million people.

WATER SECTOR REFORMS

In 1989 the government sought to provide more independence in the management of natural resources and decided to establish a new organization –the National Water Commission (CNA)– as an autonomous body under the Agricultural and Animal Husbandry Secretariat. With the establishment of CNA the decision was made to make part of its mandate the transfer of the operation, maintenance and administration of the irrigation districts to new water users associations. This, of course, gave origin to the Irrigation Management Transfer (IMT) program in Mexico.

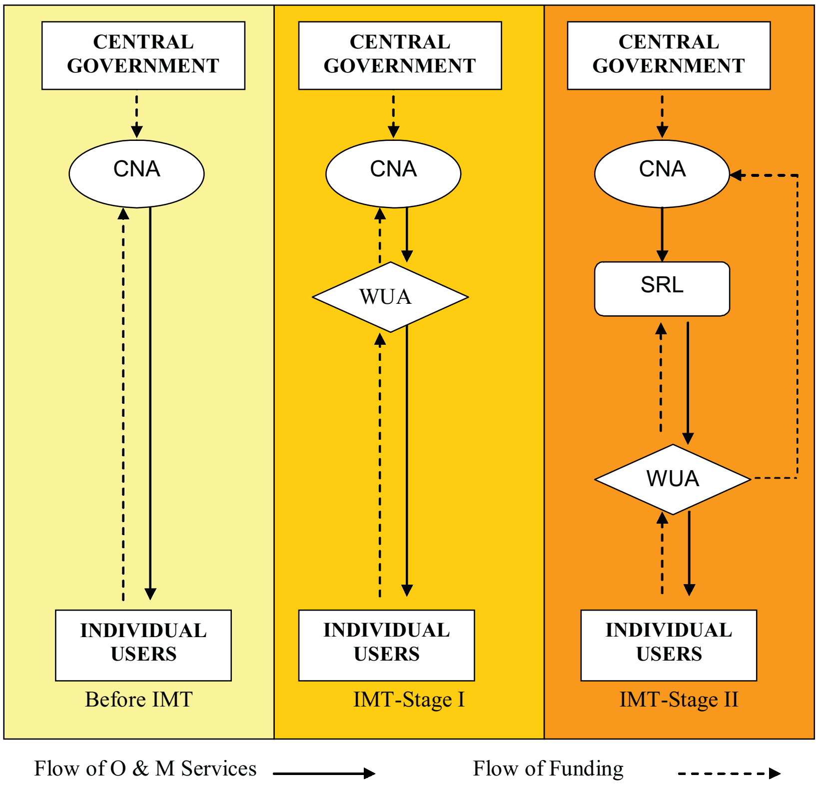
In 1992 a National Water Law was promulgated promoting the management transference of the large-scale irrigation systems to the water users and in 1994 the corresponding bylaws were announced. Also, in this year, the Secretariat for the Environment, Natural Resources and Fisheries was created and the CNA was placed under them, but again with a high degree of autonomy and independence. Additionally, in late 2004 a set of reforms on the National Water Law were approved by Congress but not yet officially implemented since the required bylaws have not been prepared. This new legal framework could allow a more decentralized water management reinforcing basin organisms and basin councils.

IRRIGATION MANAGEMENT TRANSFER PROGRAM

IMT PROGRAM PROCESS

The IMT program had the following main objectives: 1. Ensure the sustainability of the irrigation districts; 2. Reduce the financial burden of the government, 3. Transfer the responsibility for O&M to the users; 4. Increase water efficiency; 5. Improve and sustain system performance, and 6. Reduce the number of public employees in the irrigation districts.

shows the two stages of IMT: Stage I, transfer of *módulos* to water users associations (WUAs) and, Stage II, transfer of entire irrigation districts to Limited Responsibility Societies (SRL's in Spanish). During the Stage I, IDs were divided into *módulos* and WUA were constituted. Then infrastructure, equipment and machinery (below the main canal level) were officially released to these WUAs in parallel with the emission of the water concession title. In stage II, the SRL were formed grouping *modulos* from the same ID with the main responsibility of distributing water from the head-works to the WUA thereby taking control of the main system level from the agency. The SRLs expenses are covered by the WUA which apportion a percentage of their water fee income, this amount thus being subtracted from the payments going to CNA for that same purpose. In all cases the irrigation agency obtains resources from the central government, although conceivably after the transfer the central funds are to support agency operations that go beyond the services provided to the WUA. With the SRL in place, the agency looses the funds previously allocated for the operation of the main system but continues to perceive funds for the operation of dams and head-works.



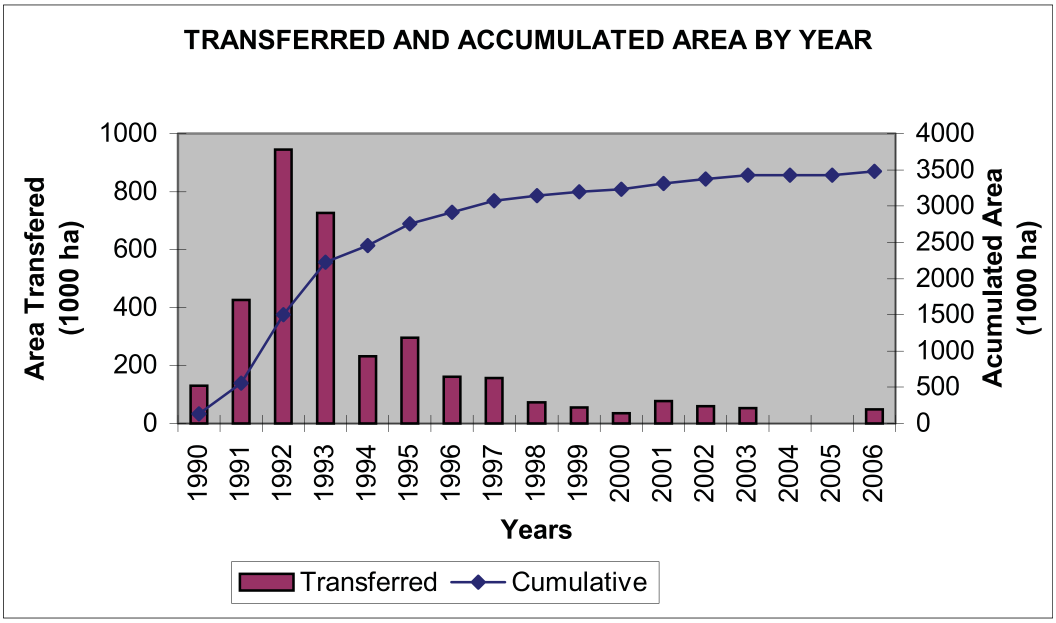
Source: FAO. Garces and Silva, 2004

Figure 6 Structure of O&M services and payments under Mexico IMT program

The WUAs may have four administrative or institutional levels: The General Assembly, the Oversight Committee, the Executive Board and Technical Unit. The General Assembly does not include all the water users but rather consists of the representatives or delegates of both land tenure sectors: *ejidos* and small growers. The main role of the Oversight Committee is to inspect the accounting records, oversee the assets and the inventory, and make sure that a financial auditing takes place yearly or when instructed by the General Assembly. The Executive Board is responsible for general management of affairs and resources, represents the WUA, and executes the resolutions of the General Assembly. Finally, the Technical Unit is composed of a General Manager and his staff that are professionals hired and remunerated under contract, and directly controlled by the Executive Board.

CURRENT SITUATION AND EVOLUTION

The IMT of the secondary network (Stage I) is practically finished; since 2001, close to 98% of the total large-scale irrigation area is already being managed by its corresponding WUA (See). According to CNA, in 2004 there were only 47,878 ha remaining to be transferred to the users and in 2006 the National Association of Water Users (ANUR) reports only 20,427 ha remaining for transfer.



Source: Adapted from CNA, 1999 for years 1990-2000; Adopted from Unified System of Water Basic Information, (SUIBA,CNA) for years 2000-2002; ANUR (2003; 2006)

Figure 8. Mexico Irrigation Management Transfer program (1990-2006)

The second stage of the IMT program is almost at a standstill since the year 2000. The 13 SRL formed so far, currently managing the main network correspond to the more profitable agriculture zones or to the largest irrigation areas. The rest of the WUAs have difficulties in forming a SRL for the following reasons:

- Modules with very low capabilities for managing the main network, which are in marginal or conflict zones,
- Individual modules that do not have a main network, and thus do not need the establishment of a SRL,
- Modules that already manage the main network by a different type of arrangement (like on a rotation basis) and they are not interested in the establishment of a SRL.
- There is some resistance from fear to loose their power and influence on the maintenance investment projects. The percentage of the water fee that is paid to the CNA without the mayor network transfer (i.e. before the establishment of a SRL) is 15 to 20%, while for those transferred is 6 to 10%.
- Finally, the official concession for the management of the main network has a long process within the CNA after the SRL is established, which discourages its formation.

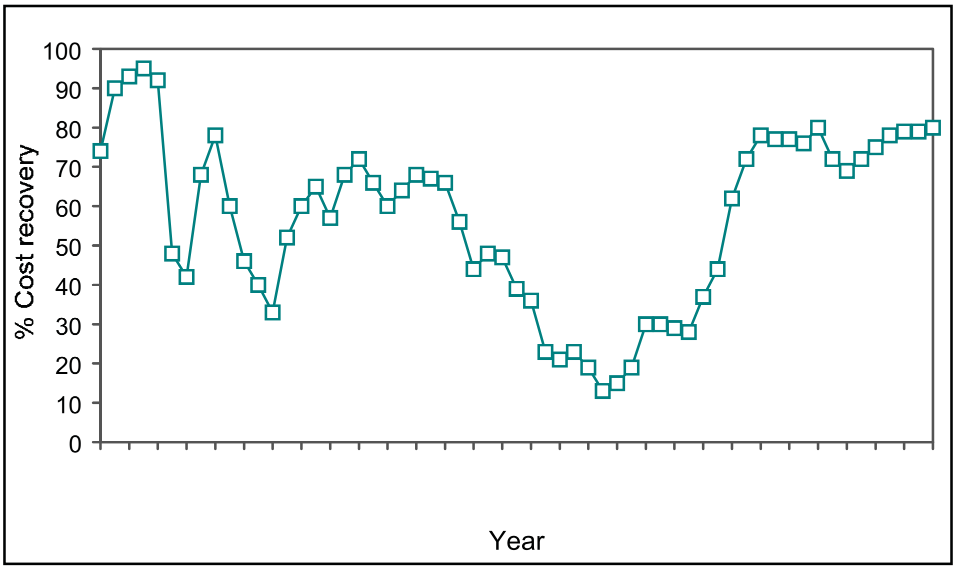
During the last few years, the role of users has gain relevance due to the impact that the National Association of Irrigation Users (in Spanish, ANUR (Associacion Nacional de.Usuarios de Riego, ANUR) is having on promoting and organizing the farmers into WUAs and SRLs. The ANUR was established in 1994 with the aim of representing the interests of water users in their negotiations with the government institutions, to provide support services in order to improve efficiency and water management, and to instruct and carry out technology transfer among its affiliates. Currently, it gathers 474 WUAs, which is 100% of the transferred ID associations and comprises 557,381 water users - 75% are *ejidatarios* and 25% from the private sector-. For financing ANUR´s expenses each member pays an annual fee of $1.5 pesos per hectare (around 15 USD cents), plus some subsidies from the CNA and other institutions. Currently, ANUR is working on the establishment of new SRLs.

RESULTS AND IMPACTS

COST OF IRRIGATION

The cost of irrigation can be measured in terms of operation, maintenance and administrative expenses (O&M&A). The assessment of IMT impact in this aspect can be portrait by the financial self-sufficiency (fss) indicator before and after the program. Financial self-sufficient can be defined as the percentage of total annual cost of irrigation O&M&A that is financed locally by water users. In the irrigation districts' fss has increase from pre-transfer levels (1989) of 43 percent to an estimated 80 percent reached in 2005 (ANUR, 2006). See .

ANUR reports that the average irrigation fee is 450 pesos/ha and varies depending on the ID area, from fees of up to $ 1,500 pesos/ha in small to only $ 400/ha in large ones. The distribution of this fee is: 50% in maintenance, 25% in operation and 25% in administration expenses. There is an average of 2.5 million hectares that are currently irrigated therefore the total income from water fees can be estimated in around 112.5 million USD.



Sources: Period 1947-1990: Johnson, 1997: figure 3, page 8; period 1989-2000: ANUR (2001); period 2002-2005: ANUR (2006). Data for other years was extrapolated.

Figure 10. Percentage Cost Recovery (or self-sufficiency) of Irrigation Districts in Mexico; 1947-2005

EFFICIENCY OF FEE COLLECTION

A major goal of IMT was for WUAs to gain financial autonomy for O&M&A needs. However, the mean 72% fss reported for the period 2000-2005 (see) was exceeded only by around 40% of the IDs; the range went from 20% to 100%. These numbers suggest that while a few districts are doing very well the large majority are not. This notwithstanding, ANUR indicates that in most districts the revenue-collection performance is around 85% since the water fee payment is a requirement for water deliver. Hence, the problem seems to concentrate in the existing gap between the required fss and the actual fee that is approved and paid by users. As expected, users try to keep the fee as low as possible even in detriment of the long-term life of the infrastructure.

The program of "*permiso único de siembra*" (in English, "sole planting authorization permit (in Spanish, Permiso Único de Siembra") was implemented in order to increase the efficiency of fee collection. This permit is granted once the users have completed their payment and it is a requirement to access other governmental support programs. Therefore, paying on time is aNormally, all users need these government support programs and therefore there is an incentive to pay the water fee on time.

QUALITY OF MAINTENANCE

The country-wide deterioration of the irrigation and drainage infrastructure was one of the leading reasons that gave birth to the IMT program. Before transfer, maintenance responsibility was entirely in the hands of the irrigation agency and was done at the district level, rather than at *módulo*-equivalent level. This created a bias towards maintenance of main canals and head-works in detriment of secondary (and below) levels. Both maintenance budgets and programs were dictated from CNA's central office and users had little influence in the works.

At the moment, WUAs pay a negotiable percentage of total fees to CNA that has kept responsibility for maintenance of dams and head-works. The percentage has been a function of amount of worked involved in terms of kilometers of canals and roads, and type of head-works. But also, on the particular negotiations undertaken between the agency and individual *módulos*. The percentages reported varies from 5 to 25%, with a diminishing tendency as the SRLs are created and take over management of the main canals. Today, the agency has a supervisory role as maintenance plans have to be submitted to them for approval. At least 60% of fee collections should be allocated to maintenance, but ANUR reports an average of only 50%.

Maintenance after transfer continues to be a problem given that many WUAs still can not collect enough fees to off-set full costs; the results is an increase in deferred maintenance in many *módulos*. According to a study by the Colegio de Postgraduados (1998), direct investment in maintenance has been decreasing in constant peso terms. CNA's contribution have diminished from 100 million pesos in 1989 to 10 million in 1997; while WUA contributions have increased from essentially zero in 1991 to 70 millions in 1997 (all in 1993 pesos).

In the Alto Rio Lerma district, the number of employees assigned to maintenance activities decreased from 81 to 65 after transfer, suggesting that the same level of effort was obtained with fewer staff, hence efficiency improved. Also, the volume of work executed increased after IMT. In the pre-IMT period from 1982 to 1992, an annual average of 438,550 m^3 of silt was removed, compared to 1.26 Mm^3 after IMT. The results show that not only there has been an increase in the amount of work done, but also that maintenance work has shifted to the lower system levels, and away from main canals (Kloezen *et al*, 1997

QUALITY OF WATER DELIVERY

Another reason for IMT was that users would improve the O&M of their systems given greater incentives to do so once it belonged to them. Several attempts to determine whether the quality of the water services, by the new WUAs have been made is shown in Table 1. The studies relate to research and field-based oriented activities carried on by the International Water Management Institute (IWMI) and others, in several districts throughout the country. Results indicate that improvements in the quality of water services after transfer have not been quite as dramatic as those reported through farmers' perceptions. The studies do show however improvements in some areas and, perhaps more importantly, that there has been no deterioration of the O&M service since transfer.

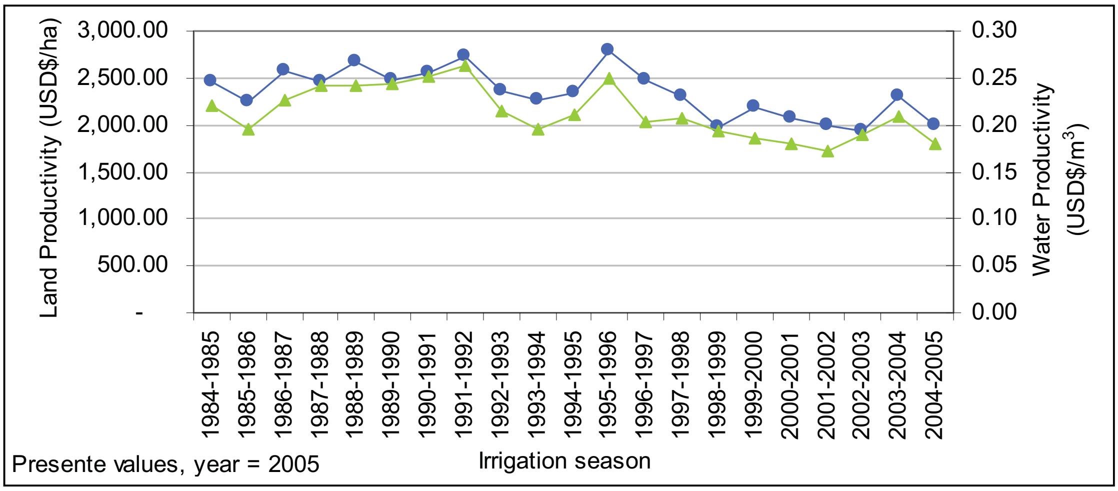
Table 1. Water delivery improvement in slected IDs

Study	Author	Year	ID studied	Type	Results	Comments
Colegio de Postgraduados	Enrique Palacios	1997	Alto Rio Lerma, Lagunera, Culiacan, Bajo Rio Bravo and La Begoña	700 users survey	84% water distribution had improved, 79% water received in timely fashion, and 64% water received in appropriate amount	Survey conducted shortly after the ID IMT and co-management with agency not yet in place
CNA		1999	229 modulos in 36 ID	Survey	Average irrigation application depth diminished by 1%	
IWMI	Kloezen *et al*	1997	Alto Rio Lerma	Field measu-rements	RWS reduction from a 2.1 pre-IMT level to 1.9 after transfer	RWS=relative water supply
IWMI		2000	Alto Rio Lerma	125 farmers survey	36% service of water distribution improved and 23% dropped. 30% timeliness water improved and 34% no improvement 40% improvement on ditch tenders performance	These results are in great contrast to those reported by Colegio de Postgraduados
IWMI	Rym-Shaw	1998	Rio Bravo and Bajo Rio San Juan	Estima-tion with second-ary data	Average RWS values, for period (1982-96), down by 0.4 in Bajo Rio Bravo and by 1.0, in Bajo Rio San Juan	Results affected by strong dry period that hit both districts in the 1990s.
IWMI	Levine, et al	1998	Lagunera		RWS values before and after IMT have remained constant, at around 1.5	

Source: Prepared based on Garcés and Silva, 2004

PRODUCTIVITY OF IRRIGATED AGRICULTURE

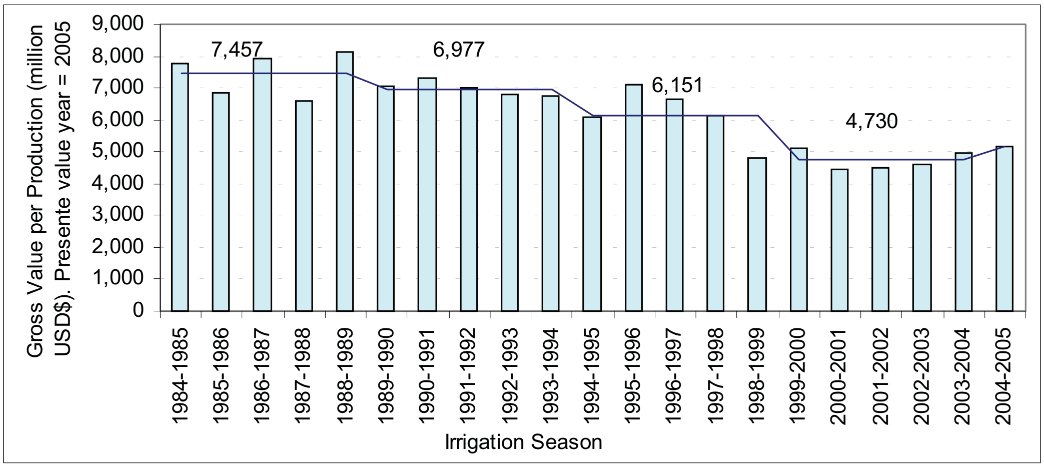
To measure land and water agricultural productivity before and after transfer indicators as changes in crop yield in ton/ha, gross value of production per unit of water supplied ($/m^3) and gross value of production per unit land ($/ha) are used. In a recent nation-wide survey done by the irrigation agency trough a contractor (CNA, 1999) it was reported that over the period 1991-1998 the productivity of land (in terms of crop yields) increased 1.85 % per year on the average. Likewise, the productivity of water (in terms of yields per unit water) increased 2.2 % per year on the average, in the all irrigation districts. In a sub-sample of 36 transferred districts, they reported increases of 2.5 and 2.8 % per year, for productivity of land and water respectively, over the same period. However, in terms of Gross Value per Production (GVP) the productivity of land and water has remained almost stable as is presented in elaborated from the official CNA statistics (1998; 1999; 2000; 2001; 2002; 2003; 2004; 2005).



SOURCE: Elaborated based on data bases from Subgerencia General de Operación, Gerencia de Distritos y Unidades de Riego, Comisión Nacional del Agua (CNA). NOTE: The irrigation season comprises from October 1st to next year September 30th

Figure 12. Land and Water Productivity in Irrigation Districts: 1984-2005

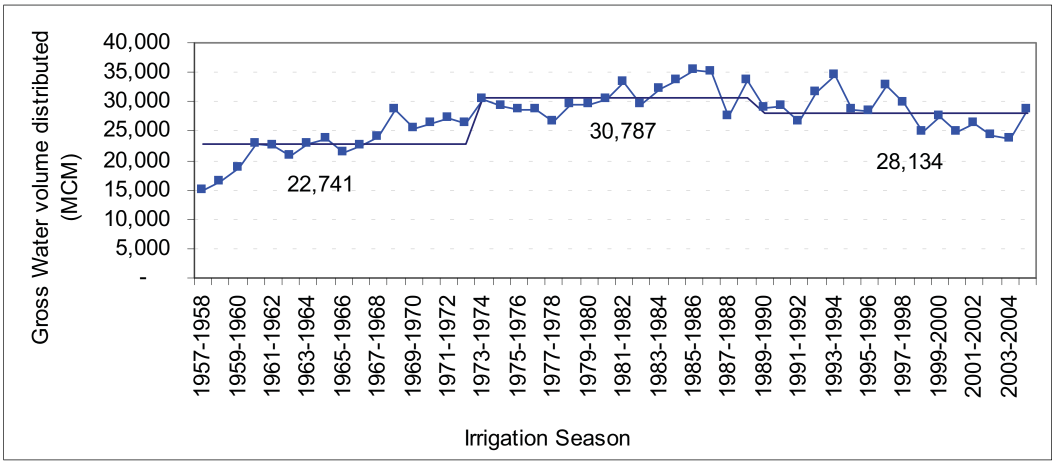
The most influential aspect on water and land productivity is the GVP. As can be observed in , the productivity indicators follow a similar trend and, can be said that, in those cases where the decrement on productivity is not proportional to the GVP decrement, is because irrigation has been more efficient or yields have increased.



SOURCE: Elaborated based on data bases from Subgerencia General de Operación, Gerencia de Distritos y Unidades de Riego, Comisión Nacional del Agua (CNA). NOTE: The irrigation season comprises from October 1st to next year September 30th

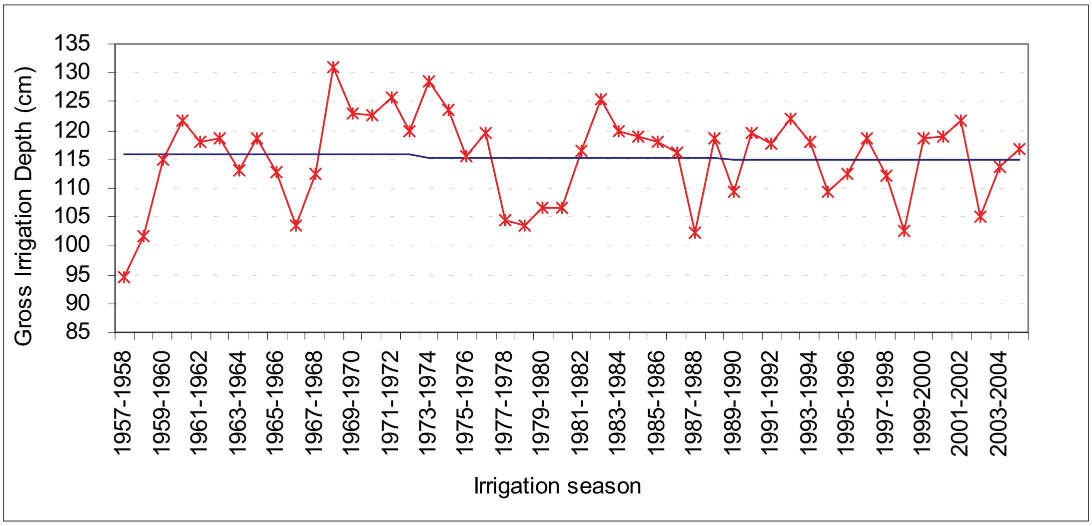
Figure 14. Gross Value per Production in Irrigation Districts: 1985-2005 and, Gross Value per Production Average, periods: 1984-1989, 1989-1994, 1994-1999 and 1999-2004

The water volume consumed by the ID has been reduced in the order of 9% after 1989 when the IMT program started. Previously, a significant increased (31%) of water volume consumption for ID took place from the period of 1957-1973 to period 1973-1989 mainly do to the construction of new reservoirs. As can be observed in , the reduction water allocated to ID is a consequence of an irrigated area reduction since the variation on the irrigation depth applied is rather small (see) and the IMT impact on this aspect is hardly observed.



SOURCE: Elaborated based on data bases from Subgerencia General de Operación, Gerencia de Distritos y Unidades de Riego, Comisión Nacional del Agua (CNA). NOTE: The irrigation season comprises from October 1st to next year September 30th

Figure 16. Gross Water volume allocated in Irrigation Districts: 1957-2005 and, Gross Water volume allocated average, periods: 1957-1973, 1973-1989 and 1989-2005



SOURCE: Elaborated based on data bases from Subgerencia General de Operación, Gerencia de Distritos y Unidades de Riego, Comisión Nacional del Agua (CNA).

Figure 18. Irrigated depth in Irrigation Districts: 1957-2005 and, Irrigation depth average periods: 1957-1973, 1973-1989 and 1989'2005

In Table 2, the productivity values for land and water for four irrigation districts that have been studied by IWMI are summarized. These studies conclude that the productivity of both land and water is relatively high in some districts, but that the values can not be related directly to the transfer program but have to be viewed in the context of other economic changes that have taken place in parallel. Those districts with better irrigation water availability (Alto Rio Lerma and Lagunera) produce higher–values crops, than those that rely more on rainfall. The combination of higher-value crops and better water availability produced higher GVPs/ha, almost double. However, the GVP per unit of water are higher in those districts with supplementary irrigation. But, as discussed above, the differences can not be attributed necessarily to IMT.

Table 2. Gross Values of Production for Land and Water in selected Districts (aveg. 1982-1996)

Irrigation District-number	GVP/ha irrigated (US $ of 1994)	GVP/m3 supplied (US $ of 1994)	Main Crops
Alto Rio Lerma -011	1422	0.10	Wheat, Maize, Veg.
Lagunera-017	1654	0.13	Alfalfa, Cotton
Bajo Rio Bravo-025	769	0.19	Maize, Sorghum
Bajo San Juan-026	728	0.14	Maize, Sorghum

Source: Levine and Garces, 2000; page 19

GENERAL CONCLUSIONS

- The IMT has produced a dramatic impact in bringing down government public expenditures in O&M&A of irrigation districts. However, government investments in modernization of the districts still represents an important share of public expenditures.
- The size of the *módulos* is a key factor in the financial self-sufficiency of the WUA on O & M. It seems that economies of scale play a role, larger *módulos* seem to cope much better
- The irrigation service has improved but perhaps not as much as it was expected
- The fact that cost recovery in most Irrigation Districts is based on the actual irrigated surface makes their financial self-sufficiency vulnerable when water availability is diminish, i.e. droughts or water reallocation. Around 75% of the Irrigation Districts costs are fixed (50% maintenance and 25% administration) which need to be covered even when the irrigation service is not fully provided.
- The agriculture production has decreased as a consequence of a reduction in water availability.
- There is still a long way to be walked by the WUA in terms of agricultural productivity. A lot could be done for further improving both land and water management efficiencies, but the real incentive for conservation, modernization and rehabilitation investments will only come through the increases in farmers' income.
- The IMT process in Mexico is almost completed; now it is necessary to monitor and evaluate the impact of IMT in the irrigation districts in particular and in the irrigated agriculture sector in general.
- There is a need to strengthen the Support Services that have been generated by IMT: water providers, technical assistance, irrigation cooperatives etc.
- There is no evidence that IMT has had a negative impact on the environment, however the process appears not to have addressed the problems related to salinity which are in fact an environmental problem on their own.

REFERENCES

1. Asociación Nacional de Usuarios de Riego (ANUR), 2002. Internal document, annual report, 2002.
2. Asociación Nacional de Usuarios de Riego (ANUR), 2003. Internal document, annual report, 2003.
3. Asociación Nacional de Usuarios de Riego (ANUR). 2006. Power Point presentation in the World Water Foroum, Mexico, 2006.
4. Comisión Nacional del Agua (CNA). 2005. Statistics on Water in Mexico, 2005/Comision Nacional del Agua.-Mexico: CNA, 2005. ISBN 968-817-561-7.
5. Comisión Nacional del Agua. 1999. Programa de Transferencia de Distritos de Riego: Avance acumulado. México, D.F., México. Septiembre.

6. Comisión Nacional del Agua (CNA). 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006. Agriculture Statistics of Irrigation Districs, season 1997-1998, 1998-1999, 1999-2000, 2000-2001, 2001-2002, 2002-2003, 2003-2004, 2004-2005. Mexico/Comision Nacional del Agua.-Mexico: CNA.
7. Comisión Nacional del Agua (CNA). 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006. Irrigated area and allocated volume in th Irrigation Districs, season 1997-1998, 1998-1999, 1999-2000, 2000-2001, 2001-2002, 2002-2003, 2003-2004, 2004-2005. Mexico/Comision Nacional del Agua.-Mexico: CNA.
8. Garces-Restrepo, Carlos y Paula Silva-Ochoa. 2004. IMT Case Study UPDATED: Irrigation Management Devolution in Mexico. FAO. Rome. Pp 40
9. Johnson III, Sam. H. 1997. Irrigation Management Transfer in Mexico: A strategy to Achieve Irrigation District Sustainability. IIMI Research Report No. 16. Colombo, Sri Laqnka: International Irrigation Management Institute.
10. Sistema Unificado de Información Básica del Agua (SUIBA). 2003. Estadísticas del Agua en México 2003. Comisión Nacional del Agua (CNA). México, D. F.

IMPLEMENTING PARTICIPATORY IRRIGATION MANAGEMENT IN VIETNAM: ISSUES AND PROBLEMS

Doan Doan Tuan[1]

ABSTRACT

In Vietnam, farmers and state have a long tradition of sharing responsibility for irrigation and today this state-farmer relationship remains strong. Recently IMT/ PIM/WUOs have been emphasized, especially under donor projects, for improvement of water management. Despite the fact that in the rural area, on-farm water management is managed by various types of formal or informal organizations, as agricultural service cooperative, village, commune, little is analyzed of how to develop IMT/PIM/WUAs. Theoretically, WUAs by hydrological boundary are recommended with little consideration of why they are needed? And how the existing organizations should be utilized?

Passing the stage of insufficient food supply to the industrial stage, agriculture role in economy declines. Low farming income makes farmers unable to pay enough to meet irrigation expenditure. Confronting with economic and social/food security roles of agriculture, the State contradicts itself in its actions: on the one hand, encourages IMT, with the hope to turn over facilities with all related cost to farmers, on the other hand wants to reduce/waive water fee for farmers to reduce their burden. These actions would have profound impact on irrigation sector and should not be overlooked.

In this paper, using information on the past period of PIM/IMT in Vietnam, supplemented by field data, the author analyzes various issues/problems of IMT/PIM in Vietnam and proposes an alternative for successful water management.

1 - Doan Doan Tuan, Ph.D, Associate Professor. Director, Center for Participatory Irrigation Management, Vietnam Institute for Water Resources Research, 171 Tay Son Str., Dong Da, Hanoi, Vietnam, Email: doantuan@hotmail.com and cpim@vnn.vn

IRRIGATION, GOVERNANCE AND WATER ACCESS: GETTING BETTER RESULTS FOR THE POOR

Simon Howarth[1], Gladys Nott[2], Umesh Parajuli[3] and Nurlanbek Dzhailobayev[4]

ABSTRACT

Expectations that WUA committees would take on leadership and management roles have, in the past, been based on unrealistic assumptions about participation, representation and accountability. Users' organisations were formed with inadequate attention to their support needs. They were often dominated by engineering and infrastructure activities so that they lapsed soon after the initial investment was complete. The establishment of the WUAs glossed over the mixed livelihood strategies of water users, the nature of relationships in socially heterogeneous communities, and the particular interests and relationships of those who were recruited as members of WUA committees. Insufficient effort and time was invested to develop skills and relationships between water users and with the WUA leadership. Technical procedures have also tended to be stereotyped and not to take account of local requirements and objectives. WUAs do not have the resources to adapt standard procedures. These problems have been observed to varying degrees on different projects, and this has often led to bad governance and erratic irrigation service delivery.

Following from this diagnosis the two interventions described in this paper were designed: 'water users' schools'; and participatory monitoring and consultation for improved water distribution. These were tested and further developed during two action research projects in seven irrigation schemes in Nepal, India and Kyrgyzstan.

The guidelines developed through this action research project incorporate a participatory process of engaging with water users to understand and adapt to local circumstances, and to implement inclusive measures which support and develop skills and relationships. However, the effectiveness of the process depends on two other key conditions: an enabling environment and long term support – including the allocation of adequate resources.

1- Mott MacDonald, Demeter House, Station Road, Cambridge CB1 2RS, UK.
E-mail: simon.howarth@mottmac.com.
2- Independent Consultant, Wickham Hall, Wickham St. Paul, Halstead CO9 2PH, UK.
E-mail: gladys@nott.u-net.com
3- Irrigation Specialist, Water and Energy Commission Secretariat, Ministry of Water Resources, Kathmandu, Nepal, E-mail: unparajuli@wecs.gov.np
4- Water Management Specialist, 4a Toktonaliev Str.,Bishkek 720 055 Kyrgyz Republic,
Email: onfarmir@elcat.kg.

The experiences reported in this paper indicate the following features should be included in a strategy to improve irrigation governance and water distribution:

- Adopt a process of engagement which includes multidisciplinary studies, entry point activities to build confidence, and activities which build human and social capital and embed the WUA in the community by developing awareness and skills and building relationships.
- Identify and work with 'Champions of Change' at all levels – local, regional and national.
- Develop capabilities for management: locally appropriate technical, organisational and governance, and financial skills – to promote trust, transparency and legitimacy.
- Ensure long term support – including practical backstopping for water users and their organisation.
- Ensure an appropriate enabling environment: legal, financial and political.

Key Words: equity, governance, human capital, india, institutions, irrigation, irrigation management transfer, kyrgyzstan, livelihoods, nepal, participatory learning and action tools, participatory management, policy, relationships, social capital, sustainability, training, water distribution, water users' associations

INTRODUCTION

This paper reports on two action research projects conducted in Nepal, India and Kyrgyzstan between 2002 and 2005 (Guidelines for Good Governance – GGG, and Equity, Irrigation and Poverty – EIP)[1]. Their aim was to improve livelihoods through better irrigation governance. The activities were undertaken on seven irrigation schemes ranging in size from 500 ha (Kamala Uttarbahini, Nepal) to 265,000 ha (Sri Ram Sagar, Andhra Pradesh, India)[2], as summarised in Tables 1 and 2.

The first project addressed general governance issues, highlighting the need to develop skills and relationships amongst water users from all categories, and with their WUA committee members. The second project applied this approach to a specific recurring issue – equitable distribution of irrigation water. Whilst irrigation management and water distribution problems are often perceived to be technical, and hence requiring

1- This work was undertaken under two DFID-funded research projects – R8023: Guidelines for Good Governance [GGG], (covering Nepal); and R8338: Equity, Irrigation and Poverty [EIP] (covering Nepal, India and Kyrgyzstan). Work was conducted in Sunsari Morang Irrigation Project (SMIP), Khageri Irrigation Scheme (KIS), Kamala Uttarbahini Irrigation Scheme (KUIS), and Bijaypur Irrigation Project (BIP) in Nepal; Obu Haet (OH), Jany Aryk (JA) in the Kyrgyz Republic; and Kadambapur WUA in Sri Ram Sagar Project (SRSP) in Andhra Pradesh, India. Fieldwork for the two projects was undertaken between 2002 and 2005. This paper is an output from the Department for International Development (DfID) funded Engineering Knowledge and Research Programme. The views expressed are not necessarily those of DfID**.**

2- The authors of this paper gratefully acknowledge the contribution of numerous individuals: Basistha Adhikari, Anjali Bhatia, Aidai Bayalieva, Hari Chaudhary, Basu Dev Dahal, Dhruba Gautam, Guy Jones, Sridar Kolluru, Joseph Plakootam, Ravi, L Sridharan, Kudret Musaev, Almaz Raimberdiev, Onno Schaap, Rob Ward all worked on the project teams. We worked with the Irrigation and Command Area Development Department of Andhra Pradesh and project offices of the Sri Ram Sagar Project; the Department of Irrigation and its district and project offices in Nepal; and the Department of Water Resources, On-Farm Irrigation Project, and *Raion* Irrigation Departments, Kyrgyz Republic. We also thank the WUAs and the water users who participated so actively and enthusiastically throughout the project, and hope they feel that they have benefited from this work

technical solutions, the process helped participants to analyze the effect of social and institutional factors as well. This enabled irrigation stakeholders to work together to improve the governance of water users' associations and the reliability, predictability and equity of water distribution.

Table 1: Case study sites – GGG (Nepal)

Project	Total Area	Type	WUA			Detailed study areas
			Name	Area	Date Estd.	
Kamala Uttarbahini Irrigation Scheme (KUIS)	500 ha	Farmer managed, built approx 1960; govt. assistance in mid-1980s and 1990s	Kamala *paini*	500 ha	1995	Entire scheme (500 ha)
Bijaypur Irrigation Project (BIP)	1,000 ha	Being prepared for transfer; upgraded /extended over 200 yrs; most recently in 1983.	Bijaypur	1,000 ha	2001	Branch Canals 3 and 4 (260 ha)
Sunsari Morang (SMIP)	58,000 ha	Joint Managed; Built 1975 rehab / CAD ongoing. Largest project in Nepal	Sitaganj (S9)	7,985 ha	1993	SS9E T-2, T-3 and T-5 (600 ha), with some coverage of whole sub-secondary canal (722 ha)

Table 2: Case study sites – EIP (Nepal, India and Kyrgyz Republic)

Country	Project	Total Area	Type	WUA			Detailed study areas
				Name	Area	Date Est.	
Nepal	Khageri (KIS)	3,900 ha	Built 1969 small run-of river	KIS	3,900 ha	1993	Spring paddy irrigation area (420 ha), focusing on BC-1 (Outlet 18) and BC-2 (pilot gate west and *pachas bigha kulo* which total 90 ha)
	Sunsari Morang (SMIP)	58,000 ha	Built 1975 rehab / CAD ongoing. Largest project in Nepal	Sitaganj (S9)	7,985 ha	1993	SS9E -T5 (140 ha), with more limited coverage of whole sub-secondary canal (722ha)
India (AP)	Sri Ram Sagar (SRSP)	265,000 ha	Built 1965 rehab on-going, reservoir backed, major inter-state river	Kadam-bapur	1,023 ha	1997	P2, P5 and P9 of M30R (69 ha)
Kyrgyz Republic	Obu Haet (OH)	1,803 ha	Built - unknown (Soviet era) rehab planned, run-of river augmented by inter-basin canal linking to reservoir	Obu Haet	1,803 ha	2002	Buvakul on-farm canal (143 ha)
	Jany Aryk (JA)	1,390 ha	Built - unknown (Soviet era) rehab planned, reservoir backed	Jany Aryk	1,390 ha	2003	Khatta Khaz 1 on-farm canal (188 ha)

THE PROBLEM

PERFORMANCE OF THE IRRIGATION SECTOR

As most participants in this conference will know well, disappointment with the performance of the irrigation sector has inspired interest in Participatory Irrigation Management (PIM), and the closely related concept of Irrigation Management Transfer (IMT) (IIMI, 1995)[1]. These concepts have emerged in the context of:

- central governments' and international donors' unwillingness or inability[2] to finance operation and maintenance of irrigation systems,
- growing competition for water, and
- a view that irrigation services can be managed better by locally-based, user-governed, organisations.

IMT has often included handing over a varying range of irrigation management responsibilities to Water Users' Associations (WUAs). The expectation has been that by virtue of their structure, their relationship with the service-using 'community', and their local knowledge, WUAs would provide a better and more sustainable service than government agencies have been able to provide.

However, the findings of this research indicate that pressure on government funding has extended to an unwillingness to provide sufficient resources to help WUAs develop skills and relationships needed to undertake effectively the management responsibilities handed to them. Furthermore, behind the expectations for WUAs have been unrealistic assumptions about their governance.

GOVERNANCE OF WUAS

Along with 'participation', the word 'governance' has come into increasing usage in the water sector[3]. There are, for example, concerns about corrupt practices, and lack of transparency and responsiveness in service delivery. But it has not always been clear what 'governance' means, and there has sometimes been a tendency to identify governance either with government or with management.

Here governance of irrigation is defined as the way decisions are made and actions are taken to manage everything to do with the irrigation resource. This is a rather dense definition, and it is helpful to expand it by identifying four key features of governance.

1- There is a very extensive literature on these topics – see, for example, FAO, 2001a; Global Water Partnership, 2000a; IIMI, 1995; IWMI, 2006;Ostrom, 1992; Peter, 2002; Peter, 2004; Plusquellec, 2002; Saleth and Dinar, 1999; Skogerboe, et.al., 2002; Svendsen et.al. 1997; Vermillion, 1997; Vermillion and Sagardoy, 1999; Vermillion, 2000;World Bank, 1996; and World Bank, 2006

2- The distinction between unwillingness and inability is highly political, and related to views about the role of the state. The interpretation of the 'fiscal crisis of the state' in the context of globalisation is also relevant. This is not the place to explore these issues, so we simply bracket these two contributors together.

3- Water governance is a term which is interpreted in many different ways. Franks (2006) provides a good overview, and other perspectives are given in ESRC, 2004; Global Water Partnership, 2000b, 2003; FAO, 2001a; Merrey, et.al., 2006 Peter, 2002; and Rogers and Hall, 2003.

Firstly, governance involves **processes for making and implementing decisions**. Decision-making processes can involve, for example, mass meetings, committee deliberations, elections, or the independent judgements of a powerful individual, etc. Decisions can be implemented e.g. by *ad hoc* or regularly organised groups of irrigators, or by staff employed by a WUA.

Secondly the processes and decisions are the **outcome of relationships** between different categories of people. This includes a range of relationships, e.g. between irrigators, between irrigators and WUA committee members, between irrigators and agency staff, between national politicians and donor agency representatives, etc. The nature of communication and access to information, with its implications for trust and transparency, is an important aspect of relationships.

Thirdly, the way that people in these relationships make decisions is **shaped by values, institutions (laws and rules), and policies**. For example, governance of water distribution is shaped by values surrounding equity and mutual obligation, rules about water theft, and policies that determine the legal powers of enforcement given to the WUA.

Fourthly, it involves the **exercise of authority**. Individuals, groups and organizations involved in irrigation determine whether WUAs have the authority to implement decisions. WUA authority depends on relationships, influence, power, legitimacy and compliance.

WATER MANAGEMENT, LIVELIHOODS AND WATER ACCESS

WUAs are usually expected to perform well because they are devolved and participatory organisations. This expectation is based on a number of assumptions about the way water users interact with each other and with the WUA. Water users are assumed to have the time and opportunity to influence and agree on matters such as canal maintenance and water sharing. Shared values and the balance of power and interests are expected to result in a distribution of water which is equitable and acceptable to all concerned[1]. WUA leaders and committee members are assumed to be willing and able to reflect and advance the interests of all water users.

These assumptions often fail to take adequate account of institutional complexity, social heterogeneity and the mixed livelihood strategies of the majority of irrigation water users. These conditions present social and administrative challenges which the WUA must address if it is to govern the irrigation service well, and protect the access of poor users to irrigation water.

All water users suffer from poor governance. They have to invest more resources to protect their access to water, and the lack of discipline affects the regularity and predictability of water supplies to their fields. The weakest water users find it hardest to cope, and suffer most. The poor (both farmers and labourers) also suffer indirectly through reduced employment opportunities, as disorganised water delivery affects the

1- Equity in formal rules is a normative concept: it says how water should be distributed in keeping with what is considered to be a fair, or even-handed way of sharing water. Most public irrigation systems in the study countries are designed to deliver water uniformly with respect to land area, according to crops grown.

crop choice and productivity of richer farmers, and hence the demand for agricultural workers.

OUR APPROACH TO PROMOTING BETTER IRRIGATION GOVERNANCE – METHODS AND FINDINGS

This action research incorporated six inter-related and mutually supporting elements, with feedback between diagnosis and intervention. The Diagnostic Learning/Action Planning in GGG, and the initial assessment in EIP, brought out governance issues and the need to develop skills and relationships. The Water Users' School intervention in GGG, and the participatory monitoring in EIP, provided further evidence of governance shortcomings and needs, while beginning the process of improving skills and relationships.

HAVING A SUPPORTIVE POLICY AND LEGAL ENVIRONMENT: IMPLEMENT POLICY AND LAWS THAT ENABLE WUAS TO CARRY OUT THEIR FUNCTIONS

The study countries were selected because the legal environment was generally considered to be sound[1]. However, the diagnostic phase of this project revealed some gaps – for example policies reiterate the need to involve women and marginal groups, but land tenure requirements and custom effectively exclude these groups from WUA membership.

Furthermore, implementation of these laws and policies is weak, and this has not been favourable for the four key features of governance listed earlier. WUAs have often been formed hastily, quickly neglecting formal commitments to continuity of support. Funds, time and effort have not been sufficient to ensure that WUAs are adequately rooted and responsive to local conditions. In SMIP this resulted in delayed elections, limited participation in decision making, and poor communications to water users. In all study sites some combination of interests in contracts, failure to act on other matters, and a common perception that the WUA is not transparent in its financial dealings, have reduced the legitimacy of the WUA in the eyes of the water users. This has undermined its authority and ability to govern the delivery of the irrigation service, and has left the regulation of water distribution and the organisation of canal maintenance to the vagaries of the values and relationships of individuals and small groups.

In the studies described here WUA members and their leadership were helped to understand their new responsibilities through measures outlined below, so that the WUAs could actually support democracy and inclusiveness, rather than perpetuate dominance by an elite group.

1- Legislation provides the basis for legal recognition and authority for water users' organisations to function. It also includes generalised objectives about sustainable and equitable irrigation service delivery.

TAILORING METHODS TO LOCAL CONDITIONS: EACH SCHEME IS DIFFERENT AND NEEDS INDIVIDUALLY IDENTIFIED SOLUTIONS

Irrigation has a different political and institutional history in each of the three countries studied, and it operates in very different conditions within each country.

WUA promotion in Nepal has been inspired by a heritage of farmer-managed irrigation which still accounts for about two-thirds of the irrigated area. Against this background, WUAs have been formed to take part at all levels in systems which previously were entirely government agency-managed. However, WUAs have been set up without adequate attention to incentives to ‘participate’ or to how this interacts with political interference. Incentives to take over responsibilities from agency-management, and politics, are also issues in India. But, in addition, the irrigation department here has historically played and still retains a more dominant role; and it feels more threatened by the introduction of WUAs. In Kyrgyzstan, by contrast, WUA formation followed the break up of large state or collective farms into a large number of small holdings. WUAs were created to take on the tasks of internal water management and coordination which were abandoned with this break-up. The state agency continued its previous responsibility for bulk water supply to the gates of the former enterprises.

These differences notwithstanding, the process of WUA development has been remarkably similar in each country[1] – with a focus on formal aspects of putting new organisations in place on irrigation schemes serving a large number of very small farm units (typically 1 ha or less).

Within each country schemes differ in size, natural and physical resources, social composition, human skills and financial assets. The teams in these studies comprised engineers, sociologists, and agriculturists and they worked with water users to facilitate the understanding of the specific characteristics of each location.

WORKING WITH WATER USERS: USE AN INCLUSIVE AND PARTICIPATORY APPROACH TO WORK WITH AND INVOLVE WATER USERS

The diagnostic studies highlighted the social heterogeneity of water users. This is associated with significant migration both into and out of the irrigated areas. Groups from differing ethnicities or castes do not necessarily communicate or collaborate, and some groups dominate others. Weak social relationships – amongst water users and between water users and the WUA – have led to poor maintenance and disorderly water distribution. The prevailing rule is ‘might is right’. Many water users are resigned to a poor service and are reluctant to become actively involved.

The participatory approach adopted by the teams aimed to explore (rather than gloss over) the social heterogeneity of the irrigation schemes. The teams used carefully designed measures drawn from the Participatory Learning and Action repertoire, so that

1- The sites included in this research are mostly typical of larger government-developed irrigation schemes in that the formation of WUAs has been part of an internationally-funded programme or project package. This package has included a combination of irrigation infrastructure works (accounting for most of the budgeted funds), changes in high level (national or state) legislation and policies, and the creation of new organisations to take on management responsibilities at the irrigation system level (Mott MacDonald, 2002 and 2006). These typical elements are summarised in e.g. Vermillion and Sagardoy, 1999; and FAO, 2001a.

all stakeholders - particularly those from marginalized groups, including women - could participate in the process of developing skills and relationships. Well-being ranking and social mapping were used to ensure that members of all social groups were identified and located[1].

After the participatory diagnosis, two key initial activities in each site were adopted: (1) identification of suitable 'entry point activities' which could be implemented relatively quickly, and (2) identification of local 'champions' willing to actively promote change. Advice or training on agricultural matters and simple measures to promote communication of irrigation schedules were adopted as entry point activities. The 'champions' were locally-respected individuals who were able to influence the WUA from inside or out, though they were not necessarily WUA members.

This approach made it possible to be inclusive when exploring irrigation issues and identifying and testing solutions to management problems. This led the way for water users and WUA committee members to be more willing to take over management responsibilities based on an improved understanding of needs and constraints, improved communication and trust, and willingness to comply with the rules.

ORGANISING OUR UNDERSTANDING: DEVELOP A MULTIDISCIPLINARY UNDERSTANDING OF THE COMPLEXITY OF IRRIGATION SYSTEMS WITHOUT BEING OVERWHELMED BY DATA

The teams used the sustainable livelihoods framework to understand the multiple uses of irrigation systems[2], the complexities of land tenure, and the mixed and varied livelihood strategies of water users[3].

In the Nepal and India sites the structure of land holdings is such that there are a large number of small land owners, combined with a small number of influential larger land owners, many of whom are non-resident[4]. Major attempts to reform land ownership have brought some redistribution of land, but it has also led to concealed ownership and short-term informal tenancy arrangements. This is most evident in SMIP in Nepal, but it is also found in the other Nepal sites where many tenants have extremely short-term agreements (often just one season at KIS) and no legal rights. This has important consequences for irrigation as the responsibilities of tenants and landlords for irrigation operation and maintenance are often ambiguous. Many farm holdings are also fragmented with individuals owning or farming land in the command area of more than one canal or WUA administrative unit.

Kyrgyzstan differs fundamentally in that land was only allocated to individuals in 1995 following the break-up of collective agriculture after the collapse of the Soviet Union. Sale of land is not yet permitted. Land holding size is fairly uniform across households

1- See Grandin, 1988; IIED and Mott MacDonald, 2004 for descriptions of these methods.

2- See DFID for practical guidelines and case studies on applications of the Sustainable Livelihoods Framework. Bakker *et al*, 1999, provide a useful discussion of multiple uses of irrigation systems.

3- The team developed an assets matrix which provided a useful structure to summarise the livelihood assets and strategies of different socio-economic categories of water users. See Mott MacDonald, 2006.

4- See Mott MacDonald, 2006 and the forthcoming report for Guidelines for Good Governance for details.

within a WUA, most landholders are owner-operators, and there is less fragmentation than in South Asia.

The teams found that the majority of irrigators, small, medium and large, have off-farm occupations in addition to farming activities. Both short-term off-farm employment and long-term long-distance migration is common in all study sites. Off-farm demands mean less time is available in the field to coordinate and cooperate with field neighbours, or participate in irrigation-related meetings. This affects reliability of irrigation as those working elsewhere have less time to spend negotiating for and guarding water supplies. It may also encourage indiscipline amongst users who irrigate to suit their time availability and convenience, rather than following rules which aim to increase order and equity in water sharing.

Male migration is increasing women's activities related to irrigation. Yet, although there is variation, women are generally subordinate to men and have less access to education, economic resources, and political power. In Nepal this varies from one ethnic group to another. For example, among Hill migrant Brahman/Chettri communities, such as those that predominate in KIS, female status is relatively better than in the Tarai 'migrant' communities, such as the Sah and Yadav which are dominant in the SMIP study area. In SRSP, Andhra Pradesh too, women are not involved in formal decision-making about irrigation, even though they provide a large part of the labour for agricultural production. In Kyrgyzstan, Uzbek villages are traditionally observant of Moslem restrictions on women, and women tend to rely on male relatives to represent them, including in irrigation matters. Women in Kyrgyz communities are traditionally more assertive and this may extend to being active in irrigation. In all sites, despite their agricultural activities and reliance on irrigation, women remain on the whole dependent on men to protect their access to water and they still have little role in decision-making on irrigation matters.

In all sites the pattern is for landholders to take individual measures to access and guard water supply to their field. Those landholders who do collaborate or negotiate with other irrigators tend to do so with a small group (less than five or six) and only for activities at a field level. They rarely collaborate to approach the WUA or the irrigation department regarding access to water. Contact tends to be made on an individual basis, particularly by those who can draw on personal relationships or influence with the ditch-rider (*dhalpa*/*mirab*/*lashkar*) or WUA committee members.

INVESTING IN SOCIAL AND HUMAN CAPITAL: THE 'WATER USERS' SCHOOL' AND FARMER OBSERVERS AS POSSIBLE MODELS

Under GGG a programme of "Water Users' Schools" (WUS) was tested on three sites in Nepal to develop those aspects of human and social capital which influence irrigation. Under EIP Farmer Observers observed, recorded and analysed water distribution practice, and reported their findings for discussion and action at community meetings.

The Water Users' School concept was adapted from the farmers' field school (FFS) approach of 'learning by doing'. FFS have previously been used on integrated pest management schools as pioneered by the FAO (1995 onwards), and later adapted to irrigation through the on-farm water management programme in Nepal (in 1997) and integrated crop and water management (ICWM) in 2002[1]. These all aimed to develop agricultural skills amongst farmers, using adult learning techniques. About 25-30 farmers attend the school for one morning a week during the crop season.

The WUS incorporated some key changes to this model in order to meet the needs identified through the studies outlined above. They

- were planned on the basis of the participatory diagnostic studies in each project, so that the methods and curriculum were tailored to local needs;
- included group activities (for institutional development, management of canals etc) as well as individual tasks, and focused on building the relationships and skills necessary to undertake them;
- aimed to enable participants to identify, understand and solve problems, not teach them solutions, and to give them the basic technical knowledge and skills to do this effectively;
- required purposive selection of participants to ensure representation of all stakeholder groups in irrigation management, and with careful curriculum design and structure of activities to encourage the participation of vulnerable stakeholders such as female heads of households and landless farmers;
- specifically aimed to disseminate knowledge and findings to non-participants, helping participants to act as trainers for other stakeholders and to learn from them, in order to ensure a cyclic learning process; and
- encouraged links between water users, WUAs, and other local institutions and agencies, making users more aware of the role of the various stakeholders, and the relevant policies, legislation, rules and regulations regarding water management.

Under EIP slightly different approaches were used in each study site to adapt to the differing history of WUA support. In SMIP the study site had the benefit of having participated in a WUS under GGG. In KIS much related work had been done previously by other agencies – this both facilitated and hindered work. The two projects in Kyrgyzstan had relatively new WUAs which had been supported by the On-farm Irrigation Project (OIP). With appropriate modifications, the process in these four case study sites involved working with Farmer Observers and WUAs for systematic observation and analysis of water distribution practices in one season, leading on to identification and introduction of changes to water distribution practices, and evaluation and adjustment at the end of the study period.

Water Users' Schools and Farmer Observers are intended to help the WUA to work effectively and in the interests of all stakeholders. This accounts for the intensive nature of these activities. But they are not offered as recipes to be directly replicated. Neither is a cheap and easy "fix". They offer approaches which are locally adapted and multidisciplinary, and which recognize varying interests, livelihoods and power relationships. They stress the need to use a range of the most effective communication methods to develop relationships and technical understandings amongst all water users. The aim is that water users will be genuinely empowered to make informed decisions,

1- FAO, 2001b provides guidelines on the use of FFS in this context.

and take appropriate responsibilities, for the sustainable delivery of the irrigation service.

PROVIDING O&M FOR INSTITUTIONS: WUAS NEED CONTINUITY OF SUPPORT

More than anything this research has shown the pitfalls and dangers of not providing sufficient resources – in funds, staff and time – to help WUAs to be developed in an organic relationship with the full range of water users they are expected to serve. This requires a genuine commitment to take measures not only to establish firm foundations for the WUA, but also to provide continuing technical and financial support during the medium term while the WUA becomes 'embedded'. The methods, time and resources required will vary considerably from place to place. But we can draw some insights from two of our case studies to estimate the level of support needed.

The WUA in the study site at SMIP in Nepal was set up a decade ago but the poor performance of WUA committees may have actually corroded relationships between water users and the WUA committees, and amongst users for water distribution. The activities described above were initiated in the first year, culminating with a water users' school (WUS) for one cropping season. This was followed by a further one-season-long activity focused on measures needed to improve water management. After the end of the two action research programmes water users still needed a third season of support to address outstanding technical and institutional issues and to put these measures on a stronger, and more sustainable, footing. The intensity of support needed (types of activities, number of support staff from different disciplines, frequency of visits) declined with each season. A much lower level of background support, with periodic visits and specialist consultancy on call, is still needed in the longer term to help to ensure that progress is sustained. Long term support must be carefully designed to avoid increasing dependency, as highlighted by observations in KIS, a site which was much studied before the start of the EIP intervention.

The experience at Obu Haet in the Kyrgyz Republic is very different from SMIP. The WUA was still being supported under OIP and faced fewer technical and social challenges than SMIP. But it was apparent that the water users had a very limited awareness of their role in the governance of the WUA, or of their responsibility to enable it to distribute water reliably and equitably. The reasons for this incomplete engagement between water users and the WUA, while quite different from the case of SMIP, can also be found in the top-down process used to establish the WUA. In common with SMIP, there are a large number of water users at Obu Haet, as land holdings are so small. In an effort to achieve democratic accountability while rationalising the numbers involved in decision-making, zones have been defined for local management and to select delegates to a Representative Assembly. But so far it has proved difficult to engage adequately with water users for WUA management.

A programme similar to the WUS – but adapted to the skills, relationships, and interests that prevail locally – would help the water users in the Kyrgyz sites to develop their own rules for water sharing, and establish self-generated discipline in water management. Here an associated programme will be needed to improve crop husbandry skills, and this could be a useful 'entry point activity'. The relatively high levels of education mean that this can be delivered in more straight-forward ways than were appropriate in Nepal, and can include printed leaflets and other written materials.

OUTCOMES OF OUR INTERVENTION

WUA GOVERNANCE

The activities described above had a positive impact on each of the features of governance identified earlier.

In each of the study sites the **processes for making and implementing decisions** were improved through a range of measures. In all sites water users from all socio-economic categories increased their understanding of how the WUA was supposed to function, they improved their contact and communication with WUA committee members, and they gained confidence to insist that committee members perform their duties actively. In SMIP and KIS they identified improvements needed in the WUA organisational structure, and in SMIP they established small task-oriented sub-committees to take action on canal maintenance and water distribution. The involvement of female irrigators without formal rights to membership was increased, and communications were improved so that water users were better informed of the irrigation schedules.

The WUS and Farmer Observer activities improved the quality of communication, mutual understanding and **relationships** between users, with the WUA and with other agencies. Safe forums were created for all water users, including those who are normally excluded, such as informal tenants from other villages and women, to meet and discuss irrigation issues and arrive at mutually beneficial solutions. It also brought all water users into closer contact with the supply agency and other support services, such as agricultural extension. This enabled the WUA to make better-informed decisions, and ensured that committee members and support services were better able to take account of different interest groups.

One outcome of the change in relationships was a greater commitment on the part of water users and WUA committee members to the **values and rules** of equitable water distribution. The recognition of the right to assert a claim to water proportionate to area of land held was particularly helpful to poor water users, who were reluctant to complain for fear that this would adversely affect their relationships and thus their livelihoods as a whole. But it was beneficial to all water users who were struggling to protect their access to water in an unruly environment.

Finally, as water users developed more confidence in the WUA committee members, the WUAs gained **authority** to implement decisions, and to define and administer penalties for those who broke rules, e.g. in relation to damaging structures, failing to participate in canal cleaning, or ‘stealing water’ and not observing distribution rules and schedules.

WATER MANAGEMENT

The ultimate aim of WUA governance is sustainable and fair distribution of water to all users. The extent to which this was achieved can be best evaluated by examining SMIP, which, unlike the other study sites, had the advantage of two years of intervention (2002-04) through both GGG and EIP.

Initially, water distribution was erratic, inequitable and did not comply with the design objectives of a structured irrigation system[1]. Subsequently, rules were designed by a sub-committee of the WUA. Crucial to successful implementation of the rules was the ability of the WUA committee members to monitor compliance, and so they were helped to develop indicators which they themselves could understand and use.

The measures undertaken under this programme resulted in a much deeper understanding of the irrigation design concept, better standards of canal maintenance, a reduction in the number of illicit actions (such as blocking canals or cutting banks), and the introduction of systematic water management through higher flow rates through a smaller number of outlets for shorter periods – all of which were directly observed during this study.

The outcome of these actions was to increase the amount of water reaching the tail of the study sub-secondary canal from about 30% of that intended to about 100%. This was achieved at the same time as reducing the total volume of water entering the canal. For example, in 2002, the flow was 6,100 m3/ha spread over 54 days, only 34 of which were scheduled to receive water as compared to a plan of 4,900 m3/ha over 44 days. After the intervention (in 2004), the delivery matched the plan – a saving of 20%. In 2002 the tail watercourses received water for 60-70% of the planned time, but this was increased to 100% in 2004.

This success was achieved as a direct result of the actions summarised in the 'Guidance for Improving Irrigation Governance', presented in the final part of this paper

LIVELIHOODS: IMPACT ON ALL WELL-BEING GROUPS – ESPECIALLY THE POOR

The limited duration of the two studies made it impossible to determine the medium and long term sustainability of results, and nor was it possible to demonstrate rigorously the impact of this intervention on livelihoods.

However, within these limitations, it was possible to observe the livelihood impact of the interventions most systematically at SMIP in Nepal. Poor water management is a cause of considerable social tension, which in turn has an impact on livelihoods and well-being. Water users identified three areas of significant progress:

- Social capital and relationships – better relations with neighbours enabled co-operation not only for irrigation but also in other activities.
- Time saving – less effort needed to repair canals or to deal with other disruption due to neglected maintenance, less time needed to manage irrigation as the timing was predictable and shorter, less effort needed to guard irrigation as others were more willing to obey rules.

1- See Albinson and Perry, 2001 for a description of this concept, which was the basis for the design of SMIP

- Crop productivity – although this is a major reason for improving irrigation management, in SMIP this benefit would only be evident in marginal areas and in unusually dry years. This was not observed in the course of this study.

Similar results were observed in the KUIS and BIP study sites under GGG. In the other sites the single season duration of the study meant that changes were either small or not observed. However, the measures to improve communications and awareness of the timing and duration of irrigation deliveries at Obu Haet did lead to an immediate reported impact in terms of relationships and reduced conflict, and this could be expected to be conducive to improved crop productivity.

LESSONS LEARNED AND UNRESOLVED ISSUES

The observed impacts are very encouraging and do suggest that this systematic and comprehensive approach to WUA establishment and support can have a significant impact on WUA governance, water distribution and ultimately on livelihoods – particularly of the poor. Part of the promise of this approach lies in learning lessons from successes and tackling, rather than ignoring, issues that remain unresolved.

Champions of Change – implementing teams have a key role as 'Champions' to improve access of the poor to the irrigation service (see also, Bird and Grant, 2005a and 2005b; Kolavalli and Brewer, 1999). They act not only as catalysts, but crucially as independent arbiters to build consensus and to stand up to existing power bases on behalf of weaker sections of the community. They also encourage local champions -- WUA committee members, individual water users, irrigation department staff members, etc. – to carry the work forward. Politicians should be engaged to support, and not obstruct, this work.

Multi-disciplinary teams - engineering specialists worked in closely knit teams with social and agricultural specialists. This was not always easy - it required a shift in expectations and ways of working. But compared with when engineers and 'institutional development' teams work separately, multidisciplinary teams are better able to respond to the reality of the integrated activities and concerns of water users and the WUAs. Nevertheless, it must be recognised that this places high demands on team skills and effort, covering a range of topics and disciplines – facilitation and training skills are particularly demanding for a project of this nature and there are a limited number of people able to carry out these tasks with the degree of sensitivity required.

Sensitive facilitators - The technical content of the schools must be very carefully designed to ensure that it is appropriate and sufficient – taking particular care to ensure that it is focused on specific needs. Facilitators must be skilled in local languages to make the 'water users' schools' effective and ensure that the poorest participants are actively involved. The curriculum of the Water Users' Schools was in some respects too complicated and in others too standard: this needs to be further refined, possibly reducing the time some participants are expected to spend at the 'school'. Also, other means of communication, such as radio, television, drama, etc. should be explored.

Understanding farming conditions and livelihood strategies –WUA formation must be based on a realistic understanding of the assets, constraints and interests of all water users. This requires: (1) understanding farming conditions and livelihood strategies of water users from all socio-economic and ethnic groups, male and female; (2) strategies to engage all groups, and (3) sufficient time to test and revise solutions, forge relationships, and develop confidence in the WUA. In this study, the participatory tools and observation techniques yielded an excess of information on one hand, and gaps and inconsistencies in data on the other. A more streamlined procedure should be developed for initial diagnosis and relationship formation, complemented with focussed supplementary investigations to answer specific questions as the need arises.

Development of appropriate technical skills – water management is a complex task, but the skills need to be presented in simple ways so that the WUA can learn practical techniques. They need to be able to design irrigation schedules which meet the specific local requirements - these often differ in small but significant ways from the idealised standard which tends to be presented in many training programmes. The WUAs also need to understand how flow measurement structures actually function, otherwise they may be interfered with simply because farmers do not understand how they work. While existing skills and knowledge are an important resource, there may be surprising gaps in this knowledge – for example, the nature of the water source and main supply channels in the case of large schemes such as SMIP. However, local knowledge on issues such as the variability of irrigation requirements is invaluable for effective water management.

Involvement of full range of stakeholders – activities should be extended further beyond all categories of water users, WUA committees and Departments of Irrigation and Agriculture to include other related support agencies, NGOs, community groups and politicians. This would open further new perspectives, and help forge social links, promote feedback, accountability and appropriate adjustments to support services, and to the legal and policy environment.

Engagement of 'losers' from management reform - those who have had privileged access to water could lose from management reform, resist engagement and obstruct changes. Therefore 'champions of change' have an important role in the sensitive task of facilitating positive engagement and negotiating with potential 'losers'.

Engagement of poor and marginalised water users - factors such as lack of time, lack of confidence, social risks and doubts about the relevance of activities to their needs, all acted against participation in programmes such as the WUS. The techniques to involve the most marginal users were only developed during the study. It is important to continue the search for better ways to allow the voice of the poor and marginalised to be heard and for their needs to be responded to, without making unrealistic or inappropriate demands on their time and efforts.

Continuing resource needs of WUAs - many irrigation systems, and their WUAs, will not be viable without continuing outside technical support. Indeed a key message is that without more support than has been given to WUAs in the past, management reforms are unlikely to yield the improved irrigation service that is expected. But WUAs need to develop and manage sustainable local financing sources for their staff and direct costs if they are to cope with declining subsidies from the government for these essential operating costs.

Political will – is needed to support governance of WUAs and to allocate sufficient resources – to support the processes, relationships, values and institutions, and legitimate authority which will enable WUAs to provide a satisfactory and sustainable service accessible to all water users.

GUIDANCE FOR IMPROVING IRRIGATION GOVERNANCE

SUMMARY OF FINDINGS

Expectations that WUA committees would take on leadership and management roles have, in the past, been based on unrealistic assumptions about participation, representation and accountability. Users' organisations were formed with inadequate attention to their support needs. They were often dominated by engineering and infrastructure activities so that they lapsed soon after the initial investment was complete. The establishment of the WUAs glossed over the mixed livelihood strategies of water users, the nature of relationships in socially heterogeneous communities, and the particular interests and relationships of those who were recruited as members of WUA committees. Insufficient effort and time was invested to develop skills and relationships between water users and with the WUA leadership. Technical procedures have also tended to be stereotyped and not to take account of local requirements and objectives. WUAs do not have the resources to adapt standard procedures. These problems have been observed to varying degrees on different projects, and this has often led to bad governance and erratic irrigation service delivery.

Following from this diagnosis two interventions were tested: 'water users' schools', and participatory monitoring and consultation for improved water distribution.

The guidelines below incorporate a participatory process of engaging with water users to understand and adapt to local circumstances, and to implement inclusive measures which support and develop skills and relationships. However, the effectiveness of the process depends on two other key conditions: an enabling environment and long term support – including the allocation of adequate resources.

The experiences reported in this paper indicate the following features should be included in a strategy to improve irrigation governance:

Process of engagement

- Champions of Change and Committed Leadership: identify catalysts to support development or reform of the WUA for each stage in the process -- from within the water user community and its leadership, and amongst other stakeholders, agencies and organisations at various levels from local, to national and international.
- Multidisciplinary Participatory Studies: undertake a rapid participatory planning study to achieve a good understanding of the irrigation system and its constraints. This should be facilitated by a team which combines social and technical skills to understand and respond to water users' livelihood strategies, priorities and constraints. Use Participatory Learning and Action tools and the Sustainable Livelihoods Framework to engage with water users and to organise observation and analysis.
- Identify entry point activities to help build confidence that some improvement is possible.

- Build Human and Social Capital to embed WUAs in the Community: ensure all socio-economic groups, male and female, are involved in a programme to develop:
  1. Awareness, understanding and willingness to participate
  2. Relationships (bonds, bridges and links)

  This activity should be combined with developing the more technical skills needed for management, which are described below: disillusionment will soon set in if the awareness is not translated quickly into tangible achievement.

DEVELOP THE CAPABILITIES FOR MANAGEMENT

1. Technical skills in their local context
2. Skills in organisational management and governance
3. Financial skills and management – for trust and transparency

Water Users' Schools and Farmer Observation and Analysis are two possible models which were tested in this study, but other communication techniques and media may be more appropriate in other situations and countries.

ENSURING LONG TERM SUPPORT

- Training and technical backstopping: provide continuing skills development and technical support for Water Users' Associations to maintain high standards of routine service provision.
- Specialist technical support: for non-routine technical problems, and to ensure that the WUAs receive a satisfactory service up to the point where their responsibilities begin.
- Financial support: ongoing budget support for the WUA, to cover the training and technical support above[1]. In some situations it may be necessary to design a realistic financial complement to the income the WUAs can be expected to generate from water users and other sources. This may include, for example, a commitment from the government to assist with emergency repairs to cope with natural disasters.

ENSURING AN APPROPRIATE ENABLING ENVIRONMENT

- Legal basis for participation: develop in response to WUA experiences and ensure WUAs have the legal authority to fulfil their responsibilities and enforce rules.

1- We focus in this paper on improvements to management rather than infrastructure, and selected irrigation systems which were in a generally sound, but not perfect, condition having recently been rehabilitated. Where some minor physical improvements are needed to reach the minimum standards necessary for the WUA to manage the project effectively and sustainably, these must be planned and implemented jointly with the WUA. The process for planning such infrastructure works is outside the scope of this paper, but it should be guided by the same principles of engagement outlined here.

- Financial basis for decentralised management: provide WUAs with the legal authority and skills to manage finances, to give water users confidence in their financial capacity, probity and authority.
- Support from irrigation supply agencies: implement incentives and orientation for agencies to provide the services and technical and managerial support WUAs need to perform their functions.
- Political support: obtain political commitment to providing necessary resources while allowing WUAs to deliver their service equitably and without interference.

PROGRAMME AND RESOURCES NEEDED

The model tested included activities over two to three seasons to strengthen an existing WUA and to support it to improve water distribution. Continuing technical backstopping and consultancy is needed thereafter. The general programme for each season would be:

- **Season 1**: Process of engagement, including embedding the WUA and initial development of skills, through an activity, such as a Water Users' School.
- **Season 2**: a follow-up but still intensive, programme focused specifically on technical, social and institutional measures needed to improve water management.
- **Season 3**: a less intensive programme which aims to help the WUA and water users to address outstanding technical, social and institutional issues in a sustainable manner, and to ensure that the legal and policy environment is supportive.

The precise content and duration of the activities which are included in each season of activities will depend on the history of WUA development and the type of irrigation scheme.

The estimated direct costs of the whole programme as conducted in the SMIP study site are around $75 - $100/ha, with the costs being split between the three successive seasons roughly in the proportion 60%:30%:10%. This can be compared with about $1,000 per ha for the rehabilitation and command area development. These costs are analysed further in the final report of GGG (Mott MacDonald, 2004). The direct costs would reduce as the process became better established, but initially the constraint would be the availability of skilled and dedicated people and organisations to facilitate the programme.

No infrastructure was built during this study, but if infrastructure rehabilitation is being planned at the same time as WUA establishment and development, the two aspects need to be implemented in a coherent and integrated manner[1]. Detailed rehabilitation planning should start once the initial work of embedding the WUA is well-advanced.

1- Rehabilitation and institutional development are sometimes separated into two discrete activities, for pragmatic reasons. This division should be resisted, as infrastructure and institutions are but two facets of the same problem. Good governance demands that they should be tackled together.

CONCLUSION

Water Users' Associations have played an important part in irrigation reforms in many countries, but there have been difficulties in ensuring that they are sustainable and that all stakeholders benefit fairly. Prospects for replication and sustainability depend above all on two factors: (1) a willingness to face the facts: there are no quick and easy shortcuts for establishing effective WUAs; short one-off training linked to a rehabilitation programme is not only unrealistic but likely to be counterproductive; and (2) the political will to make the necessary investment in genuine engagement with water users to meet local requirements – with all the messiness this represents, and the conflicts that will have to be resolved.

REFERENCES

1. Albinson B and Perry C. 2002. Fundamentals of Smallholder Irrigation: the Structured
2. Irrigation System Concept, IWMI Research Report 58, Colombo, Sri Lanka, 2002
3. Bakker, M., Barker, R., Meinzen-Dick, R. and F. Konradsen (eds). 1999. Multiple Uses of Water in Irrigation Areas. A Case Study from Sri Lanka. SWIM Paper 8, International Water Management Institute, Colombo, Sri Lanka
4. Bird, Kate and Grant, Ursula. 2005a. Policy Influencing and Media Engagement: an Overview. Paper for ODI Chronic Poverty Research Centre. http://www.chronicpoverty.org/CPToolbox/PolicyInfluence_MediaEngagement/2% 20Overview%20Paper/2-%20Policy%20engagement%20overview% 0paper(UG,%20KB)%20 final.pdf
5. Bird, Kate and Grant, Ursula. 2005b. Understanding the key opportunities and bottlenecks when using research to influence pro-poor policy change. Overview. http://www.chronicpoverty.org/CPToolbox/PolicyInfluence_MediaEnga gement/3.4%20Oppo rtunities%20and%20Bottlenecks/1-Summary%203.4%20(KH)%20final.pdf
6. DFID. Sustainable Livelihoods Distance Learning Guide. www.livelihoods.org
7. ESRC. 2004. 'Launch Seminar Notes'. The Water Consensus – Identifying the Gaps. Launch Seminar, Bradford, ESRC-Funded Seminar Series. Bradford, UK. http://www.odi.org.uk/wpp/News_Events/ESRC_leaflet.pdf.
8. FAO. 2001a. IMT E-mail Conference: Overview Paper: Irrigation Management Transfer Sharing Lessons from Global Experience, June 2001. http://www.fao.org/ag/agl/aglw/waterinstitutions/overview.stm
9. FAO. 2001b. GUIDELINES FOR PARTICIPATORY TRAINING AND EXTENSION IN FARMERS' WATER MANAGEMENT, Provisional version (PT&E-FWM). (Rome: FAO AGLW - Water Service of the Land and Water Development Division). CD-Rom.
10. Franks, Tom. 2006. "Water Governance: A solution to all problems". Paper presented at ESRC-funded Seminar on Water Governance – New Perspectives and Directions. Final seminar February 20-21 2006.

11. Global Water Partnership. 2000a. Towards Water Security: A Framework for Action. GWP Secretariat, Stockholm, Sweden. www.gwpforum.org.
12. Global Water Partnership. 2000b. Making water governance effective: themes for action. GWP Secretariat, Stockholm, Sweden. www.gwpforum.org.
13. Global Water Partnership. 2003. Dialogue on Effective Water Governance: Learning from the Dialogues, status report for 3rd World Water Forum in Kyoto, Japan, March 16-23, 2003. GWP Secretariat, Stockholm, Sweden. www.gwpforum.org.
14. Grandin, Barbara. 1988. Wealth Ranking for Smallholder Communities: A field Manual. London: ITDG.
15. Groenfeldt D & Svendsen M 2000. Case Studies in Participatory Irrigation Management, World Bank Institute, Washington.
16. IIED. Participatory Learning and Action. PLA Notes. http://www.iied.org/NR/agbioliv/pla_notes.
17. IIMI. 1995. "Summary Report of the FAO/IIMI Expert Consultation", Irrigation Management Transfer in Asia, Bangkok and Chiang Mai, Thailand, September, 1995.
18. IWMI. 2006. Beyond More Crop Per Drop, Web site prepared for the 4th World Water Forum, 16-22 March, 2006, Mexico. http://www.iwmi.cgiar.org/WWF4/html/index.htm
19. Kolavalli, Shashi and Brewer, Jeffrey D. (1999). "Facilitating user participation in irrigation management" in Irrigation and Drainage Systems 13: 249-273).
20. Merrey, Douglas J., Meinzen-Dick, Ruth, Mollinga, Peter Pl. and Karar, Eiman. 2006. "Policy and Institutional Reform Processes for Sustainable Agricultural Water Management to Reduce Poverty: The Art of the Possible", Chapter XIV of the IWMI Comprehensive Assessment of Water Management in Agriculture. http://www.iwmi.cgiar.org/Assessment
21. Mott MacDonald. 2002. Guidelines for Good Governance: Stage 1 Report. Cambridge: DFID KaR R8023.
22. Mott MacDonald. 2004. Guidelines for Promoting Good Governance by Water Users' Associations. DFID KaR R8023, Final Report, Cambridge, UK
23. Mott MacDonald. 2006. Equity, Irrigation and Poverty: guidelines for sustainable water management. Cambridge: FID KaR R8338.
24. Ostrom, Elinor. 1992. Crafting Institutions for Self-Governing Irrigation Systems. San Francisco: Institute for Contemporary Studies.
25. Peter, J. Raymond. 2002. "PIM - Lessons From International Experience," http://files.inpim.org/Documents/PIM_JRP.
26. Peter, J. Raymond. 2004. "Participatory Irrigation Management", http://www.maff.go.jp/inwepf/documents/inaugural/inpim-note.pdf.
27. Plusquellec, Herve. 2002. How Design, Management and Policy Affect the Performance of Irrigation Projects - Emerging Modernization Procedures and

Design Standards. FAO: Bangkok, Thailand. http://www.fao.org/docrep/004/ac799e/ac799e00.htm

28. Rogers, Peter, and Hall, Alan W. 2003. Effective Water Governance. TEC Background Papers No. 7. Global Water PartnershipTechnical Committee. TEC.: Elanders Novum, Sweden.
29. Saleth, R. Maria, and Dinar, Ariel. 1999. Water Challenge And Institutional Response: A Cross-Country Perspective. World Bank Policy Research Working Paper. WPS 2045 www.worldbank.org/html/dec/Publications/Workpapers/home.html
30. Skogerboe, G.V., Merkley, G.P., Rifenburg, R.F. 2002. Establishing sustainable farmer-managed irrigation organisations. www.greatunpublished.com.
31. Svendsen, Mark, Trava, Jose, and Johnson, Sam H. III. 1997. Participatory Irrigation Management: Benefits and Second Generation Problems. Lessons from an International Workshop, Centro Internacional de Agricultura Tropical. Cali, Colombia. February, 1997. World Bank Electronic Learning Guidebook for Participatory Irrigation Management. Economic Development Institute of the World Bank, Washington, DC.
32. Vermillion, Douglas L. 1997. Impacts of Irrigation Management Transfer: A Review of the Evidence. IWMI Research Report 11. P O Box 2075, Colombo, Sri Lanka
33. Vermillion, Douglas L. 2000. “Old And New Paradigms For Water And Development”, Paper to the Workshop on Water Resources and Irrigation Sector Reform: Principles and Framework of Program Implementation, October 2000, Jakarta.
34. Vermillion, Douglas L. and Sagardoy, Juan A. 1999. Transfer of Irrigation Management Services: Guidelines. FAO Irrigation and Drainage Paper No. 58. Food and Agricultural Organization of the United Nations, Rome, Italy.
35. World Bank. 1996. Participation Sourcebook. Washington, D.C.: The World Bank.
36. World Bank Water for Food Team. 2006. “Reengaging In Agricultural Water Management: Policy and Institutional Options for Decision Makers”. Agricultural and Rural Development Notes, Issue 3, February 2006.

CHALLENGES AND NECESSITIES OF APPLYING PARTICIPATORY APPROACHES AND MECHANISMS TO AGRICULTURAL WATER MANAGEMENT

H. Shabanali Fami[1], H. Iravani[2], Z. Zarei[3] and A. Mokhtari[4]

ABSTRACT

This paper provides an overview on the challenges and essentials for understanding the starting point of changing a top-down oriented water management towards participatory irrigation management (PIM) and also highlights the elements of the underlying concept and already achieved successes.

In recent years, agricultural water has helped meet fast-rising demand for food, and has contributed to the growth of farm profitability and poverty reduction as well as to regional development and environmental protection (Ward et. al, 2005). Irrigation provides some 40% of the world's food from only 17% of the global cropped area. At present, 2400 million people depend on irrigated agriculture for food and livelihood and with global population to increase to 7.9 billion in 2025; additional food will have to come from irrigated agriculture. Hence, water development is critical for food security in many regions of the world. Irrigated agriculture is dominant user of water accounting for 80% of water consumption. (Peter, 2004). According to recent reports, over 60% of the world's irrigation is in Asia. Since 1965, the irrigated area has almost doubled so that irrigated agriculture is now a main source of food security, higher farm incomes and increasing rural population's welfare in Asia (Barker, 2002).

CONCEPT OF PIM

Inappropriate management of irrigation has contributed to environmental problems including excessive water depletion, falling water tables due to excessive mining and water quality reduction, water logging and salinization, poor irrigation practices accompanied by inadequate drainage that have often damaged the soil build up. In the past the governments have been solely responsible for development of irrigation sector. The general trend toward decentralization, fiscal crisis in governments, inadequate maintenance on irrigation systems, the growth of private sector, focus on other social sectors and highly staffed bureaucracies has led governments to divest most of its roles

1- Assistant professor, Dept. of Agril. Extn. & Educ., University of Tehran (hfami@ut.ac.ir)
2- Associate professor, Dept. of Agril. Extn. & Educ., University of Tehran
3- & 4- Msc students, Dept. of Agril. Extn. & Educ., University of Tehran

to the private sector and to user organizations. At present WUAs, progressively take over responsibilities and the role of government and irrigation agencies through adopting community-driven approaches (Rosegrant and Ximing, 2001; Peter, 2004).

PIM is a key term in the toolbox of current approaches to improve the efficiency and performance of water resources management in the countries that are to cope with the issue of water scarcity, or problems associated with global and climate change in the foreseeable future (Regner et al., 2006). The term PIM refers to the participation of users – the farmers in all aspects and levels of irrigation management. All aspects include planning, design, construction, operation and maintenance (O&M), financing, decision rules and the monitoring and evaluation of irrigation system. All levels include the primary, secondary and tertiary levels. From another viewpoint, PIM usually refers to the level, mode or intensity of user participation that would increase farmer responsibility and authority in management process. A more comprehensive variant of PIM is Irrigation Management Transfer (IMT). IMT is the full or partial transfer of responsibility and authority for the governance, management and financing of irrigation systems from the government to water users associations (WUAs) (Vermillion, 2003; Peter, 2004). Groenfeldt (2003) states that PIM processes build two forms of capital: productive capital (better maintained irrigation infrastructure) and social capital (new institutions such as WUAs, skills, leadership and community action) (Peter, 2004).However, there is a growing concern on the need for PIM/IMT approaches due to their following advantages:

- Reducing financial and budgetary difficulties of government,
- Improving irrigation management efficiency,
- Better and timely Operation and Maintenance (O&M) of irrigation infrastructure,
- Changing farmer's attitude of over dependence on external assistance,
- Positive experience on new institutional arrangements that can be extended to other areas,
- Promoting community activities,
- Facilitating collection of water fees. (APO, 2002; Saleth and Dinar, 1999).

Apart from this, an appropriate PIM approach has to decrease risks of water supply and maintenance costs of the pressurized conveyance system, a higher security of water supply through improved reliability of the system and the increase of cultivated areas due to a lower share of buffer zones within irrigation plots which are apart of farmers reaction against the risk in water supply. In addition, PIM should be designed and implemented in a way to reduce conflicts between farmers. It is because improved and more transparent communication structures originated by adoption of PIM reduce a number of conflicts between farmers and the need for interventions of governmental authorities in local dispute (Regner et al., 2006).

A review on the various PIM approaches, adopted across the world indicate that establishing WUAs is central and crucial for ensuring the efficiency of these approaches.

WATER USERS ASSOCIATIONS (WUAS)

The paradigms for rural development pursued and practiced in developing countries have transformed greatly since the 1950s. Failure to achieve intended result through transfer of technology policies caused shift towards a more user – centered approach to development and people first development model based on popular participation gained popularity in the 1980s and 1990s (Bukey, 1993; Chambers, 1997; Cernea, 1991; Khanal, 2003). Accordingly, the focus of water resource management has also shifted from technology transfer towards decentralized and user – centered approaches emphasizing participation and local organizational development (Clyma, 1986; Uphoff, 1986; Khanal, 2003). This change has happened through promotion of local water management by users organizations commonly referred to as water users association (Vermillion & Sagardoy, 1999; Meinzen-Dick et al., 2002; Johnson et al., 2002). Several countries, such as Mexico, Turkey, Indonesia, the Philippines, Colombia, India, Sri Lanka and Nepal, adopted policies to encourage greater management participation by water users since the mid-1980s. These experiences witness demonstrable improvements in economic water use efficiency, sustainability and a more responsible handling of water resources and public funded installations (World Bank, 2002).

In fact, WUAs are in charge of the maintenance of the conveyance system and bear the responsibility for the water distribution. The experiences of WUAs are important criteria to be considered for improvement in the functions and mechanisms of PIM approaches. For example, gained knowledge on traditional farmers association in irrigation management allowed for the identification of three core elements which characterize successful WUAs in the Jordanian context;

a) Farmers participate actively in the bodies which settle final decisions in water management but are hesitant to participate in purely consultative organizations.

b) A precondition for farmer's participation seems to be the accessibility of resulting benefits by the farmers in advance either by experience or by credible accord with the respective authorities.

c) A formal, transparent management system reduces or at least clarifies the impacts of informal power structures and relationship between individuals on the management of water resources. In brief, three years experience of WUAs in Jordan yielded the following indicators of success in the water management: a) regular distribution of water, b) increasing of WUAs control over water meters at regular intervals and c) a significant drop in the areas of destruction of water meters, valves and pipes. According to Jordan experience the outline of the WUAs should be based on the principle of:

- One voice per field with irrigation outlet,
- The election of a directorate for each WUA,
- The official registration of WUAs for embedding them in the legal framework of national development plans (Regner et al., 2006).

Since 1954 Turkey has had a legal framework allowing the transfer of management proceeded at a very modes pace until 1993, when the program received new impetus and the rate of transfers accelerated sharply. Since that time, the program has successfully transferred about one million hectares to local management. The PIM was adopted in 1986 in Turkey for enhancing user's participation and their self-control in the irrigation management (Burak, 1999; Svendsen and Nott, 1998).

In India, a high level of efficiency in performance by WUAs in function like irrigation water distribution and resolution of conflicts is reported (Joseph, 2001).

The study of successful experiences of WUAs in different countries as mentioned earlier indicate that to achieve the successful and promising process of introducing participatory structures into irrigation schemes, the following points should be taken into consideration;

- Promotional programs for explaining the advantages of participatory irrigation management are essential initial activities for successful transfer programs. This can be done through meeting, workshop and the distribution of pamphlets.
- The election of a WUA is a critical action for the future of the association.
- Successful transfer requires an appropriate legal framework to clearly define the rights of water, forms of organization, the responsibility of each party and the manner in which activities should be regulated.
- Fiscal benefits must be considered for companies that manage the irrigation and drainage infrastructure.
- A transfer program should be accompanied by continuous training for both WUA directors and their operating staff.
- A simultaneous restructuring of the policy agency is required for transferring the responsibilities and tasks from governmental organizations to WUAs (Regner et al, 2006).

Facon (2002) believes that the sustainability of the WUAs depends on their capacity to provide an adequate water delivery service and control as well as improved service to allow the agricultural productivity to take place. In conclusion, efficiency of irrigation systems to enhance productivity can be better when local knowledge, labor, money and other inputs are mobilized through WUAs (Peter, 2004).

CHALLENGES FOR PIM APPROACHES

The current, technically sound approaches of management in water distribution face serious problems within the social and economic context, since they allow for significant incentives from illicit action by all concerned parties. Reported incidents range from deliberate damage of water meters to circumvent regular billing of water charges and temporary depressurization of the conveyance system by perforation of tubes for illegal water extraction up to informal lobbying that obstructs the performance of the administrative system (Regner et al., 2006). For example, in Philippines, irrigation administrations face constraints to perform their responsibilities. These constraints include: accelerated deterioration of irrigation infrastructure, lack of production capital, stringent bank lending procedures and directive political interventions (Avelino, 2002). Development of salinization and water-logging as well as reduction in irrigation water quality and efficiency are other problems of agricultural water management in other countries (Khasankhanova et al., 2001; Khasankhanova, 2003).

In Jordan, Low participation of water users in the irrigation water management makes governmental administrative bodies to be confronted with many challenges. A study shows economic and social consequences of this approach in Jordan as follows:

- Increased maintenance costs for the JVA (Jordan Valley Authorities) due to manipulations of water meters and valves and therewith connected destruction of concrete boxes and illegal tapping of the pressurized pipe.
- Loss of public funds through unaccounted water extraction by manipulated or destroyed water meters and uncontrolled water extraction of surface water from the King Abdullah Canal via the illegal use of mobile pumps.
- Additional investments by farmers in private ponds and pumping equipment to store water in order to counteract potential disruption of the irregular water supply by the system of the JVA.
- Further additional costs for farmers through opportunity costs from combinations that renounce on parts of profit margins in favor of risk reduction and by introduction of uncultivated buffer zones in the irrigation plots in order to cope with unreliable water supply.
- An increased social cost due to social strives in the farming community as well as between aggrieved farmers and the administrative authorities that are responsible for the timely provision of water.

Hence, the Jordanian government decided in 2001, to counteract these problems by gradually introducing new participatory elements into the water management of the Jordan Valley Irrigation Scheme (Regner et al., 2006).

Transfer of irrigation management in Turkey faces the following challenges:

- The difficulty in reducing staff levels,
- The absence of a changing mechanism for bulk water supply to irrigation associations,
- The indistinct vision of a new role for the agencies in supporting the existing irrigation systems in the post-transfer era,
- The undefined nature of water rights and subsequent insecurity of their claims on irrigation water,
- Restricted options for obtaining maintenance equipment by WUAs,
- Lack of legal basis to form federations for WUAs (Svendsen and Nott, 1998).

According to the experiences gained in Asia, in spite of many successes PIM approaches still face following constraints:

- Inadequate knowledge of officials as well as farmers about management transfer,
- Limited coordination between farmers organizations (FOs) inadequacies in government support and difficulties in sharing power,

- Inadequacies in legislation and regulatory mechanisms,
- Lack of incentives for the government agency staff to effectively involve in PIM,
- Price and market problems and resulting decline in farmer profits. (APO, 2002).

In investigating challenges faced by PIM approaches, Khanal (2003) found that hierarchical organizational structure, lack of organizational learning, shorter time frames, and failure to link the project while the broader development objectives all pose barriers in maintaining participatory processes for irrigation management. Moreover, lack of knowledge on water resource system was reported to be a major constraint in embedding participatory approaches in water management which comes from lack of initial learning of the system environment both by the users and outside facilitators. In should be considered that irrigation systems are sociotechnical systems and technology of the system is shaped by ecology and society. Hence, it has both human and physical dimensions (Khanal, 2003). Lack of financial sustainability is another major constraint to remote resource mobilization for operation, maintenance and improvement of the irrigation systems (Peter, 2004).

NECCESITIES FOR SUCCESS OF PIM APPROACHES

For PIM approaches to be efficient, necessary preconditions should be provided. Some of the most important ones are as follows:

CAPACITY BUILDING:

Supporting WUAs through participatory design process to build up the capacity to manage water and provide better working conditions through more compatible technologies and water management practices is highly important. It should not be merely viewed as a training program aimed at bridging gaps in knowledge and skills among farmers and agencies but also as facilitating the change process (Peter, 2003; Bryan and Helmi, 1996; Khanal, 2003).

REGIONAL COOPERATION:

Since most Asian countries have a similar context in irrigation, regional cooperation by sharing of experiences and study tours could prove invaluable. A powerful mechanism by which this could be achieved is the creation of farmer networks at the national level or through PIM chapters. PIM chapters are non profit organizations and comprise of membership of WUAs, irrigation engineers, researchers and farmers (Peter, 2004).

ESTABLISHING FARMER NETWORKS

Farmer networks and federations could provide a platform for debate on water sector and irrigation reform issues, so that farmers get an opportunity to take part in policy formation and receive intense consultation (Peter, 2004).

ADAPTATION TO THE LOCAL SETUP:

Experiences from several countries indicate that introducing participatory elements in the relationship between mostly governmental decision makers on water resources and end users of water is an essential, but neither detached nor standardized process in the complex setup of successful water resources management. The differences between the applied participatory approaches support the assumption that PIM cannot be transferred from one situation to another without modification, but the successful implementation of PIM in a specific case, crucially depends on its sensible adaptation to the local situation (Regner et al., 2006).

IMPROVED SERVICE DELIVERY:

The sustainability and efficiency of a WUA depend to large extent on its services to the members. Most of the irrigation systems are quite old and require rehabilitation and modernization in order to be capable of providing easy-access, reliable and equitable services to their users (Peter, 2004).

COPING WITH THE COMPLEX INCENTIVE SYSTEMS:

One of basic needs of efforts towards an improved utilization of water by introducing participatory elements in water resources management is to cope with the complex incentive structures of individuals on the levels of farmer's communities and within the administration (Regner et al., 2006).

ACCESS TO ASSURED WATER SUPPLIES:

In order for farmers to participate in the process of irrigation management they should be provided with water entitlement as well as efficient input and output markets (Ward et al., 2005)

ANALYZING TRADITIONAL MANAGEMENT MODEL:

In order to come out with an efficient PIM, the first attempt is to analyze traditional management models within irrigation communities and to identify informal management approaches of country to acquire basic knowledge on more suitable starting points. This proved to be a successful measure in Jordan (Ghneim et al., 2005).

SECURING WATER RIGHTS:

For WUAs to be successful, they need to be vested with a clear water right to give the right incentives for improvement of the irrigation system. Secure water right also protects the WUAs from infringements of its allocation and share of water to other powerful interest such as industries and municipalities (Peter, 2004; Bryan and Helmi, 1996).

DEFINING A LEGAL FRAMEWORK FOR WATER USER ASSOCIATIONS

WUAs should be empowered through well defined legal frameworks that specify clear roles and responsibilities among agencies, WUAs and governments. This legal framework gives WUAs a fair degree of freedom and power to exercise its authority (Peter, 2004; Bryan and Helmi, 1996; Burak, 1999).

REQUIRING TECHNICAL ASSISTANCES AT INITIAL YEARS OF THE TRANSFER

WUAs need technical assistance by central government to repair and maintain water structures with equipment. This support can be gradually decreased over the years. This is a crucial issue in the case of small WUAs which are weak and face challenges to fulfill their tasks properly (Burak, 1999).

Other essentials for successful PIM approaches are as follows:

- Identifying socially acceptable mechanisms,
- Evaluation of former – less successful approaches,
- To reduce the cost of irrigation management for the government (Vermillion, 1997).
- Defining the rights and duties of all the parties involved under PIM approach,
- Flexibility in the operation of the irrigation system (Lele and Patil, 1999),
- Attempt to consider end users demand in irrigation management,
- providing farmers and WUAs with appropriate subsidies and financial supports (Wijayaratna, 2002),
- Profiting farmers by subsidies, improved irrigation management and additional training (Regner et al., 2006),
- Strengthening the managerial capacity of FOs or WUAs,
- Establishing multi-functional business organizations where in irrigation management is an integral part of the overall business,
- Full transfer of responsibilities,
- Provision of technical assistance and skill development,
- Establishing transparent and people-centered M&E system based on a set of objectively verifiable indicators (Wijayaratna, 2002),

CONCLUSION

Irrigation water management is a dynamic and complex process containing various stakeholders. Adoption of any participatory process such as PIM/IMT should be practiced beyond an instrumentalist perspective but rather based on a transformative perspective. A successful PIM approach should be based on complete involvement and cooperation of various stakeholders at different levels and from different sectors ranging from top governmental body to the end users. Particularly, the role of water users is crucial because they can help in establishing realistic water price and implementing water protection and distribution measures. Involvement of water users in the decision-making processes is essential to prevent or settle conflicts among themselves. For improving the role of WUAs, it is essential to take constituent factors into considerations which are: laws and policies of the country and its irrigation agencies, size and complexity of the irrigation systems, physical condition of the irrigation systems, size of irrigated farm holdings, farmers net income, capability and organizational arrangements of WUAs, local politics, local social customs and practices, frequency of natural disasters and environmental problems (Benjamin and Bagadion, 2002). According to APO (2002), PIM can be enhanced further by facilitating the process of strengthening FOs, WUAs and similar organizations, assisting in capacity building, supporting through other services such as timely supply of complementary inputs, regulating credit facilities, providing legal support, appropriate policy changes and political supports.

For PIM to be succeeded, farmer's income and benefits should be taken as a critical factor to improve their capacity to meet irrigation costs. In addition, PIM models should be matched against socio-political and economic environment of the country. PIM has to infuse a sense of ownership to the users. It would be necessary for countries experiencing initial stage of PIM to follow a gradual process of withdrawal of government control and intervention on irrigation management. A legal framework is also required for well-functioning of PIM which covers formulating of supportive policy and environment. Klozen (2002) call it as "institutional engineering". However, it should be noted that full participation of farmers in irrigation management will be achieved just when they involve in setting priorities for agricultural policy.

REFERENCES

1. APO. 2002. Organization Change for Participatory Irrigation Management, Report of the APO Seminar on Organizational Change for Participatory Irrigation Management. Philippines, 23-27 October 2000 (SEM-32-00), Tokyo.
2. Avelino M.M. 2002. Participatory Irrigation Management in the Philippines: Issues and Constraints. Report of the APO Seminar on Organizational Change for Participatory Irrigation Management. Philippines, 23-27 October 2000 (SEM-32-00), Tokyo.
3. Benjamin, U. and Sr. Bagadion, 2002. Role of water users Associations for Sustainable Irrigation Management. Report of the APO Seminar on Organizational Change for Participatory Irrigation Management. Philippines, 23-27 October 2000 (SEM-32-00), Tokyo.
4. Barker, R. 2002. Recent Developments in Irrigation Management in Asia and the Pacific. Report of the APO Seminar on Organizational Change for Participatory Irrigation Management. Philippines, 23-27 October 2000 (SEM-32-00), Tokyo.

5. Bryan, B. and Helmi.1996. Participatory Irrigation Management in Indonesia. National Workshop on Participatory Irrigation Management, November 4-8, Jakarta, Indonesia.
6. Burak, S. 1999. Participatory irrigation management activities and water user organizations involvement in Turkey. Mediterranean Commission for Sustainable Development, Turkey.
7. Burkey, S. 1993. People First: A Guide to Self Reliant Participatory Rural Development, ZED Books Limited, London and New Jersey.
8. Cernea, B.M. 1991. Putting people first, Sociological variables in rural development, Oxford University Press.
9. Chambers, R. 1997. Putting the First Last, Whose Reality Counts? Intermediate Technology Publications: London.
10. Clyma, W. 1986. Irrigated agriculture: a comparative analysis of development concepts, In: K.C. Nobe and R.K. Sampath (Eds.) Irrigation management in developing countries: Current Issues and Approaches: Studies in Water Policy and Management, No. 8, Westview Press/ Boulder and London.
11. Facon, Th. 2002. Improving the Irrigation Service to Farmers: A Key Issue in Participatory Irrigation Management. Report of the APO Seminar on Organizational Change for Participatory Irrigation Management. Philippines, 23-27 October 2000 (SEM-32-00), Tokyo.
12. Groenfeldt, D. 2003. Background paper on Participatory Irrigation Management .Circulated at the World Water Forum III.
13. Ghneim, A., Bakir, P. and J. Regner, 2005. Rural communities sharing surface runoff-a survey of experience in irrigated agriculture in Jordan. Report of the project on water resource management in irrigated agriculture. German Technical Cooperation, Amman, Jordan.
14. Lele, S.N. and R.K. Patil, 1999. Farmer participation in irrigation management –A case study of Maharashtra, Society for People's Participation in Ecosystem Management and Horizon India Books.
15. Johnson III, S.H.M. Svendsen, and F.Gonzalez, 2002. Options for institutional reform in the irrigation sector. Discussion Paper for the International Seminar on Participatory Irrigation Management 21-27, April 2002, Beijing.
16. Joseph, C.J. 2001. Beneficiary participation in irrigation water management: The Kerala experience, Centre for Development Studies, Thiruvananthapuram, Discussion Paper, No 36. India.
17. Khanal, P.R. 2003. Participation and governance in Local water Management. Irrigation and Water Engineering Group. Wageningen University, The Netherlands.
18. Khasankhanova, G, Abdullaev, U., Pavey, J., et al. 2001. Integrated Solutions for Point and Non-point Pollution in the Amu Darya basin of Uzbekistan, IWA the 5th

International Conference on Diffuse Pollution and Watershed Management, Milwaukee, USA.

19. Khasankhanova, G. 2003. Public Participation to Improve Water Resource Management in Uzbekistan, Diffuse Pollution Conference, Dublin.
20. Klozen, W.H. 2002. Accounting for Water: Institutional Viability and Impacts of Market – Oriented Irrigation Intervention in Central Mexico. PhD Thesis. Wageningen University, The Netherlands.
21. Meinzen-Dick, R., Raju, K.V. and Ashok Gulat, 2002. What affects organization and collective action for managing resources? Evidence from canal irrigation systems in India. World Development, Vol.30 (4): 649-666.
22. Peter J.R. 2003. "Capacity Building for PIM-The case of Andhra Pradesh, paper presented at the FAO/ICID International Workshop on Capacity Building for Irrigation and Drainage, Montpellier, France, 2003.
23. Peter J.R. 2004. Participatory Irrigation Management. International Network on Participatory Irrigation Management, Washington DC. INWEPF/SY/2004(06).
24. Regner, Jochen, H., Salman, A.Z., Wolff, H.P. and E. Al-Karablieh, 2006. Approaches and impacts of Participatory Irrigation Management (PIM) in complex, centralized irrigation systems-experiences and results from the Jordan Valley. Conference on International Agricultural Research for Development, University of Bonn, October 11-13, 2006.
25. Rosegrant, M.W. and Ximing, C. 2001. Water for Food Participation. Brief 2 in Overcoming Water Scarcity and Quality Constraints, 2020 Focus9.
26. Saleth, R.M. and Dinar, A. 1999. Water challenge and institutional response: A cross-country perspective. Rural Development Department, The World Bank, Washington, D.C, USA.
27. Svendsen, M. and Nott, G. 1998. Irrigation management transfer in Turkey: Process and outcomes. Advanced Short Course on: Capacity Building for Participatory Irrigation Management (PIM). Valenzano, BA (Italy) 7-23 September 1998.PIM-Case Studies, V.2p.59-60.
28. Uphoff, N. 1986. Getting the process right: improving irrigation management with farmer's organization and participation. Working paper, Cornell University, Ithaca, New York.
29. Vermillion. D.L. 1997.Impact of Irrigation Management Transfer. Research Report 11. Colombo, Sri Lanka: IIMI.
30. Vermillion, D.L. 2003. Irrigation Sector Reform in Asia: From Patronage under Participation to Empowerment with Partnership .In Asian Irrigation in Transition .New Delhi: Sage Publications.
31. Vermillion, D.L. and Sagardoy, J. 1999. Transfer of Irrigation Management Services. FAO Irrigation and Drainage Paper 58.

32. Ward, Ch., Dargought, S., Minasyan, G. and G. Gambarelli, 2005. Reneging in agricultural water management: challenges, opportunities and trade-offs. Agriculture and Rural Development (ARD), The World Bank.

33. Wijayaratna, C.M. 2002. Requisites of Organizational Change for Improved Participatory Irrigation Management. Report of the APO Seminar on Organizational Change for Participatory Irrigation Management. Philippines, 23-27 October 2000 (SEM-32-00), Tokyo.

34. World Bank .2002. A handbook to get the involvement of irrigation users in all aspects of irrigation management, and at all levels. Environment and Natural Resources Division (EDIEN) & New Products and Outreach Division (EDINP) World Bank Institute (WBI), of the World Bank.

FRUITS OF PARTICIPATORY IRRIGATION MANAGEMENT

Mrs. Charu Bhavsar[1], Er. Pradeep Bhalge[2]

ABSTRACT

Water is a scare commodity. It can not be created, but it get replenish. Rainfall is the major source of water for the human being. It is highly erratic in nature. Major parts of the earth do not receive the rains throughout the year. The average rainy days may vary from 10 to 45 from the arid to semiarid region. Therefore management of the water resources became an essential function of the society. Community management of the water resources had proven over time to be very successful and sustainable. This approach ensures its optimum utilization, conservation, and maximizes the benefits. Large numbers of such example are scattered throughout India. Involvements of the people's participation in construction of water harvesting structures and irrigation water management of harvested water shows that the community can bring revolution in the water management sector. The successes story sets very good examples of participatory approach and could inspire the people facing the problems of water crises. This paper illustrates few successful cases of the participatory Irrigation management practiced in India.

INTRODUCTION

Out of the total use of available water 70 to 80% water is used for irrigation. Thus irrigation sector is the largest user of the available water resources. Irrigation makes the food security. Though productivity enhanced by several other factors like soil nutrients, hybrid seeds and crop husbandry, water acts as catalyst and it is most important input for higher productivity. But the availability of water is highly variable with space and time. India often reels of flood and drought. The ancestors had taken lessons form the erratic behavior of the monsoon rain and evolve various skillful traditions of participatory approach in creation and irrigation management of the water resources. Few cases of successful participatory irrigation management are given below.

1- Indian Council for Water and Culture, Aurangabad, Maharashtra, India.
2- Irrigation Engineer and Executive Council member of Indian Council for Water and Culture, Aurangabad, Maharashtra, India.

SPRING CHANNELS

Polar River is flowing in Tamil Nadu state, India. It has a wide bed of thick sand. During the period of north east monsoon, the river has subsurface flow of water i.e. water springs below the sand bed. The flow period is sufficient to raise one seasonal crop. The inhabitant on the bank of river had developed an art to tap the underground aquifer to irrigate their fields. They identified few spots inside the river beds in the lower reaches. Each village on its banks developed a right to a spot. On such spot the villagers use to dig a pit. The depth of the pit may be 3 to 4 meters i.e. up to the underground water spring. The spring is the water source. The spot is called as *Kasam*. The villagers dug an open cut channel form the *Kasam* leading to wards their field on the downstream side and along the bank of the river. The channels are slightly inclined and away form the bank of the river and have certain gradient to ensure easy flow of water form the *Kasam* to the tail portion. The land in between the river bank and the channel is the command of the *Kasam*. It has a command of few hectares. The *Kasam* can sustain for the crop period. The spring water carries sand along the flow. The sand gets deposited on the bed of the channel and obstructs the water flow. Therefore day to day sand removal from the channel is necessary. The Villagers evolved a very good Participatory approach for day to day maintenance of the channel. One member form each family of the beneficiaries has to contribute the cleaning activities. All of such member gather early in the morning on the channel banks and starts cleaning the channel form the head to wards the tail to rejuvenate the spring. One village do not encroach the *Kasam* of the another village. This tradition is still in practice form long back. This is the simple but very effective illustration of Participatory Irrigation management.

MINOR IRRIGATION TANKS

Large numbers of Minor irrigation tanks are exist in Tamil Nadu state, India. Management of these tanks is in the hands of the beneficiaries. They nominate a respective person in the village as the in charge of the irrigation under the tank. He has irrigation assistant called as *Neerkattis*. Under the directives of the leader *Neerkatties* distribute the water to the different fields. They strictly follow a specific turn of water distribution. This turn system might be evolved centuries back but still adopted. The statement in the turn sketch gives the extent of the irrigation from Monday through Sunday. It also specifies the time of irrigation to a certain areas of the field. For how long the turn schedule is in vogue, nobody knows, but still honored. This is one of the best examples of the Participatory irrigation management.

PHAD SYSTEM OF IRRIGATION

The community managed Phad irrigation system is prevalent in northwest Maharashtra, India, i.e. part of Dhule and Nasik districts.The system is in operation in the Tapi river basin. Weirs were constructed to divert the river water for agriculture use. The command area of a diversion weir is divided in to four equal parts, called as Phad. Each Phad has to grow only one type of crop in a season. Cropping pattern is decided so wisely that the first Phad may have a perennial crop, second may have a two seasonal crop, third may have a one seasonal crop and forth may be kept fallow. Each Phad has a provision to raise perennial crop in every four years. The crops in the Phad are kept rotating one after the other. The rotation of the crops is given in the table below.

Year (Rabi)	Phad no one	Phad no two	Phad no three	Phad no four
I	Wheat	cotton	Gram	Fallow
II	Fallow	Wheat	cotton	Gram
II	Gram	Fallow	Wheat	Cotton
III	cotton	Gram	Fallow	Wheat

From the above table it is observed that every Phad has an opportunity to grow all types of crops by rotation. Irrigation to the crops in the fields is performed by the appointed staffs. And farmers are not allowed to interfere in irrigation operation. The farmers need not to worry about the irrigation and guarding the crops in their field. The irrigation staff does their best as they have to get share from the individual field produce. Maintenance is a group function. All farmers contribute equally both in labor and leadership. Discipline is strictly enforced. The Phad system shows that if small farmers organize, they can form a sustainable irrigation system. The crops are rotated from one Phad to another and frequently one Phad is kept follow in rotation. Because of frequent non irrigation and crop rotation the lands do neither get water logged nor get saline, though the irrigation is practiced here from centuries back. Thus fertility of the lands is maintained. The water distribution practice and the management rules are so framed that they sustains for a long period. The Participatory irrigation management of the available water in the weir is said as one of the best system of management.

MALGUZARI TANKS

The tank irrigation in Wainganga River Basin of Maharashtra, India are locally known as Malguzari tanks, they are very good example of Participatory irrigation management and water resources development. These tanks are still in use in the district Bhandara, Gondia, Chandrapur, Gadchiroli and Nagpur since centuries to gather. Dynastic in this tribal area was known as 'Gound King ` inspired the people to undertake large number of tank. These tanks were constructed in earthen embankment for harvesting water and irrigation purpose. Solely the people through farmer's participation built the tanks. The farmer's committees also look after the water management of these tanks. More than 20,000 tanks were constructed in this area. Some of the tanks are small and known as Bodis. These were owned by the individual beneficiary/family.The tanks were constructed in series. They did not have well defined conventional surplus water arrangement. The location of the dam line was so fixed that the surplus water could find its own way either through flanks or saddle.

JOHADS

The Tarun Bharat Sangh stepped in to Guwara Dewari village of Rajasthan state, India, with its integrated development package. Under this package they constructed three earthen water harvesting structures called *Johads* using 10000 man days in the year

1986-87. In July 1987, 130 mm rain fell in a period of 48 hours. There after there were no rains. But the ample water was collected in the *Johads*. Due to which ground water aquifer is recharged and the water level in the 20 well rose up and fulfills the drinking water needs of the peoples. The bed in the larger *Johads* is used to cultivate the crops where as water in the smaller *Johads* was used for livestock. Some organic debris that flowed in to the *Johads* beds from the catchments enriched the soil fertility. About 30 tonnes grains were grown in these beds. For the construction of *Johads*, they have not taken any external engineering help. Initially the people were suspicious. But very soon they realized the importance of *Johads*. Due to construction of the check dams across the drain the precious top soil erosion prevented. By learning the lesson from this, the peoples from other villages also started to construct *Johads* in large numbers. They put an example of what a community can do for its prosperity if it unites together. The village environment has been revived. Luxurious tree now grow in the vicinity of the Johads. Previously soil erosion from the cultivated land was remarkable and soil moisture was very low. After initiation of the Johads the soil erosion is prevented and it remains moist for long period. In 1986, 60 youth from 57 families had migrated in search of the job. Today, neglibile numbers of men are employed out side the village. In the past, village women had to fetch for water and spent time and effort to collect the water from the distant sources but now they are getting water in there wells. Construction of the Johads does not solve the problems. It requires regular maintenance. Need of skilful irrigation water management rose for their sustainability. Decisions regarding the use of the Johads are taken by the villagers themselves. The maintenance of the Johads is the collective responsibility of the villagers. The revival of the traditional water harvesting has been extremely successful. The flow of wealth fro the village Gopalra has prevented. Thus the standards of living of the villagers are improved. Since the year 1986, 200 Johads are constructed in 100 village of the Alwar district.

CONCLUSION

Participatory irrigation management is very much successful for maintaining the sustainability in agricultural production and efficient land and water use.

REFERENCES:

1. Few Glimpses of Indian water culture, Dr. R.S. Morwanchikar. Proceeding of National Workshop, Indian Council for water and Culture, 15-16 October, 2005.
2. Region in the historical Gond Kingdom, Dr. Harishchandra Borkar,Proceeding of National Workshop, Indian Council for water and Culture, 15-16 October, 2005.
3. Management of Irrigation tanks in Tamilnadu, Prof. A.Mohankrishnan, Proceeding of National Workshop, Indian Council for water and Culture, 15-16 October, 2005.
4. Dying Wisdom, A book published by the Centre for Science and Environment, New Delhi (India).

PARTICIPATORY IRRIGATION MANAGEMENT IN KIRINDI OYA IRRIGATION AND SETTLEMENT PROJECT

Wijesundara. Mudiyanselage. Gunawardana. Banda. Giragama[1]

ABSTRACT

The Kirindi Oya Irrigation and Settlement Project (KOISP) located in the southeast quadrant of Sri Lanka was completed in 1986 and during the same year, water issues commenced. The KOISP consists the old Ellegala Irrigation System (EIS) Project area (4,090 ha) and New Irrigation System (NIS) area (5,340 ha). Water management in this project is performed in four levels: main canal handled by the Irrigation Department (ID), secondary canal by Distributary Channel Organization (DCO), tertiary canals by Farmer Organizations (FOs) and field level canals by individual farmers. Up to 1990, the old EIS and the NIS were managed as two separate entities. During 1990, these were formed into a single Project Management Committee (PMC) and the ID with the assistance of IWMI prepared the seasonal operational plans for both seasons with much consultation and communication between and among the stakeholders. The drainage flow to the sea from the EIS and NIS has reduced considerably due to this water management practice. The successful completion of 1999 *yala* cultivation was due to the participatory irrigation management system offered by the officers, DCO leaders and FO representatives. Due to high participation of the EIS the farmers got less number of dry days and they reported that more than 71% adequate water delivery was available in all crop growing stages. Further they obtained high yields ranging from 3.9 to 7.7 ton/ha. The farmers in the RB of NIS reported 24% and 10% adequate water supply in booting stage and flowering stage respectively and they obtained less yields ranging from 0.6 to 3.2 ton/ha.

1. INTRODUCTION

Sri Lanka a tropical country, which lies between 6^0 and 10^0 N latitude and between 80^0 - 82^0 E longitude has an extent of about 65,610 square kilometers. It is an island in the Indian Ocean, and a predominantly rural, agro based economy with few industries and with a limited population. Integrated Water Resources Management was not a pressing issue. Demand for water in every economic sphere is increasing with an unhealthy competition resulting in an unregulated exploitation and threatening the degradation of

1- Research Fellow and Head/Irrigation Water Management and Agrarian Relations Division
Hector Kobbekaduwa Agrarian Research and Training Institute
P.O. Box 1522, Colombo 7, Sri Lanka. Email: hartiiar@sltnet.lk, gbgiragama@yahoo.com

quantity and quality and depletion of a resource. With the transformation of the agrarian society into an urban society, the main issue that the water sector is faced with is to meet the growing sectoral water demands such as domestic, industrial, irrigation agriculture and hydropower.

The overall objective of the National Water Resource Management Policy is to encourage integrated water resources development and management, to ensure that the national water resources are conserved and efficiently and equitably allocated among all stakeholders to meet socio economic and environmental need of the present and future generation (Draft National Water Resource Management Policy, 2006).

Based on water resources issues and management needs, the recommendation of the institution responsible for water resource management areas should be declared. Comprehensive sustainable water resource management plans need to be formulated through identification of distinctive characteristics specific to different zones and areas.

National Water Resource Management Policy (2006) states that the system of water allocation will be based on a participatory decision making process, represented by all stakeholders with technical input on optimal operation for meeting anticipated seasonal and multi- seasonal water demands for various regions and sectors, and the environment. It also states that the allocation of water among different users will be in accordance with the water resource management plans prepared for the each river basin region, river basin or aquifer.

In Sri Lanka, the southeast quadrant received less rainfall than other dry zone areas and the Kirindi Oya is located in this quadrant. The upper part of the Kirindi Oya basin is mountainous with a fewer number of settlements. The lower part consists mainly of agricultural lands under major, medium and minor irrigation systems and rain-fed farming systems. KOISP is in Tissamaharama Electorate, Lunugamwehera Divisional Secretary Division Hambantota District. This basin is narrow and extends from Bandarawela at 1900 m. MSL to a distance of 120 Km. to the sea at Kirinda.

The total drainage area is 1,178 sq. kms. And the catchment area at Kirindi Oya reservoir site is 909 sq. kms. Thin forests and scrub jungle are found between 600 m to 1,900m. elevations, which comprise 19% of the catchment. The catchment terrain can be divided into a steep section from 1,900 m MSL to 180 m MSL and thereafter a flat plain extending 50 Kilometers from Wellawaya to the dam site at Lunugamwehera. Presently this area receives less than 1,500 mm of annual rainfall which is not favourable for rain fed agriculture.

In late 1980's, after bidding adieu to their relatives in their home towns, more than 5,000 families aimed from various parts of the country to settle under KOISP with great expectations of a comfortable life. However, these expectations became a distant dream as the inflow to the Lunugamwehera Reservoir was far below the expected level, high percolation rates of soils in the command area persisted and cultivation of traditional paddy in lands were suitable only for other food crops.

Various other solutions were proposed for the water shortage problem of the farmers who were settled under the new system of KOISP and they endured great difficulties during last two decades.

The Kirindi Oya Irrigation and Settlement Project (KOISP) includes the old Ellegala Irrigation System (EIS) Project area (4,090 ha) and New Irrigation System (NIS) area (5,340 ha). The main component of KOISP was Lunugamwehera reservoir and the main two canals which were completed in 1986 and water issues commenced from 1986 Y*ala* season (April to August). Annual rainfall was 1,152 mm and it spread during Y*ala* season (380 mm) and *Maha* season (September to March - 810 mm). Reference Crop potential evapotranspiration is 2,000 mm. Average inflow to Lunugamwehera reservoir was 392, 315, 290 and 279 MCM during the years of 1977, 1986, 1994 and 2000 respectively (IWMI 2001). It showed that the inflow reduced from 392 to 279 MCM during 1977 -1999 period. Hence, water scarcity was the main problem here.

Water management in this project was performed in four levels. Those are the main canal handled by the Irrigation Department (ID), secondary canal by Distributary Channel Organization (DCO), tertiary canals by Farmer Organizations (FOs) and field level by individual farmers. From the commencement of the KOISP in 1986 and until 1990, the old EIS and the NIS were managed as two separate entities by the Irrigation Department (ID) without much consultation and communication between and among the stakeholders. Prior to 1991, seasonal allocation decisions in Kirindi Oya were generally taken in a Project Management Committee (PMC) meeting presided over by the Government Agent (GA). Under the Integrated Management of Major Irrigation Systems (INMAS) programme, farmers were grouped on the basis of hydrologically based organizations. These organizations select farmer representatives who sit with officials from relevant agencies, including the ID, on joint management committees that make seasonal allocation decisions and resolve various problems. The top-level joint committee is the PMC and is chaired by the Project Manager from the Irrigation Management Division (IMD). The INMAS advocates the establishment of a pyramidal committee structure operating on three tiers; FOs, DCOs, and the PMC. In the case of Kirindi Oya, a single PMC was constituted in 1990 by combining the PMCs of the old EIS and NIS. In light of participatory irrigation system management, PMC is the legitimate decision making body for seasonal allocations (IWMI 2001).

After the formation of a single Project Management Committee (PMC) in 1990, the ID with the assistance of IWMI prepared seasonal operational plans for both *yala* and *maha* seasons, taking into account the storage in Lunugamwehera reservoir and the five EIS tanks at the time of planning (generally November 1), expected 75% percent probable inflow to reservoir and the zoning of the NIS with priority order to receive water and commence the *Maha* cultivation in stage level. This zoning procedure was necessary because of the inadequate water inflow into the Lunugamwehera reservoir.

According to PMC decision the water allocation in 1999 to new area of left bank (LB), right bank (RB) and old area was 39.996, 57.320 and 57.19 MCM respectively. The drainage flow to sea from the EIS and NIS has considerably reduced due to this water management practice. Farmers became more disciplined in receiving water and using it effectively due to the higher management effort of DCO leaders and field channel representatives. The re-use of drainage water has considerably increased due to this method during both 1999 and 2000 *Yala*. The successful completion of 1999 *Yala* was due to participatory irrigation management of lower level of ID field officers, DCO leaders and FO representatives.

The KOISP planned to augment irrigation water supplies for the existing irrigation systems of Ellegala and Badagiriya which cover 4,500 ha. Besides, the project intended to provide irrigation facilities through the Right Bank and the Left Bank Main Canals from the newly constructed Lunugamvehera reservoir for an additional area of 8,400 ha. (IWMI 1995). The annual projected paddy production for KOISP was set at 44,000 mt. During 1993 the actual production amounted to 41,000 mt. (IWMI 1995).

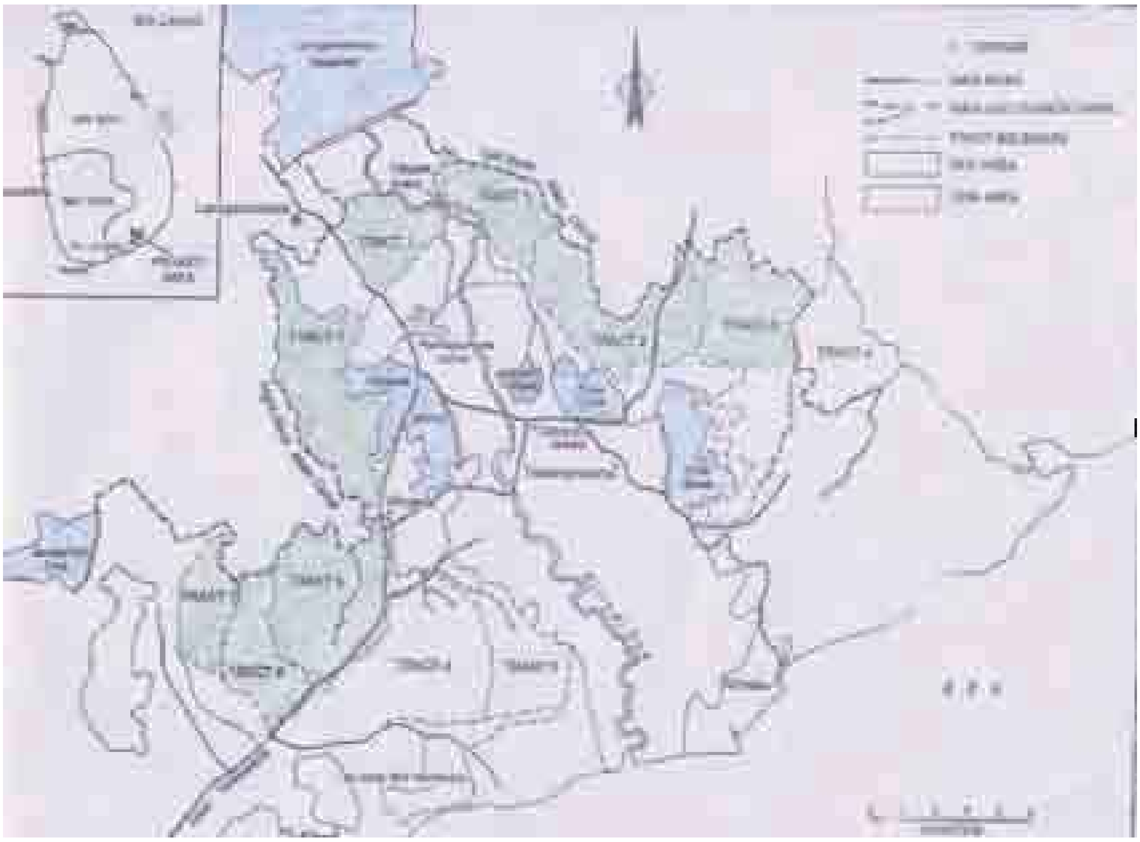


Figure 1. Map of KOISP

The rural Deevelopment society dominates among the extraneously- initial organizations in both NIA and OIA. However, the OIA as the more stabilized community reported higher settler membership as well as awareness of the organizations. (Gamage et at 1988). Many organizations in the OIA were more established with higher membership. In the NIA settler organizations have not established themselves as yet, their emergence uptro Yala 1986 indicates that systematic development of a community sense was underway in NIA (Gamage et at 1988).

PADDY PRODUCTION

Paddy yield in the old area at 6.5 mt/ha in 1985/86, this was 6% below the national average 96.8 mt/ha). Hoowever and new irrigated area yield was 2.4 mt/ha in yala 1986.

METHODOLOGY

DATA COLLECTION

Several methods were adopted for colleting the required data for this paper**.** Reservoir outflow data and meteorological data were collected from the Department of Irrigation and secondary data are presently available. The drainage data of command area and time series of monthly inflow data to Lunugamwehera reservoir were obtained from the IWMI database which were mentioned in HARTI publications and data for other information collected at the IWMI/HARTI collaborative study in 2003. The minutes of the PMCs and IWMI publications were perused to find out the decisions made at different stages of planning during and before the crop growing season. The author collected some field data and information from DCO leaders agencies involved in operating and managing the system and farmers. Additional information was ascertained through a questionnaire which was pre-tested and refined. The questionnaire survey conducted in year 2003 with a sample of 220 households in 11 villages of in Kirindi Oya Basin. The farmers' answers to the questionnaire were analyzed and the results of the farmers perceptions and their views were discussed with the system-operating agency to authenticate the veracity of the farmers responses.

Relationship between monthly rainfall and inflow of the KOISP was analyzed using simple regression analysis. Data used for the analysis compare of 1991, 1992, 1997, 1998 and 1999 years.

RESULTS

Based on the questionnaire survey in Kirindi Oya Basin, male and female population is indicated in the Table 1. This shows that the male population is 52.3% and female population is 47.7%. According to that, more male population in both age groups and that is a positive situation considering heavy labour requirements for agriculture.

Table 1: Number and percentage of households classified by age and sex

Unit	Age range	Male		Female	
		No.	%	No.	%
Kirindi Oya Basin	<18 Years	172	49.6	175	50.4
	Years 18<	371	53.6	321	46.4
	Total	543	52.3	496	47.7

Survey data 2003

Distribution of family members according to their marital status is shown in Table 2. Married percent age is 63.4%, and this can be construed that their mental conditions are helpful for participatory activities. Percentage of unmarried is 31.4% in the sample. This poses a drawback for participatory activities and agricultural production.

Table 2: Distribution of family members according to their marital status

(Age 18 years and above)

Marital status	**No.**	**%**
Unmarried	222	31.4
Married	449	63.4
Divorced	4	0.6
Widowed	30	4.2
Other	3	0.4
Total	708	100

Survey data 2003

The people of Kirindi Oya have to travel a distance of about 0.6 km to draw water during the season. Mean distance travel for water during off season in the Kirindi Oya, according to descriptive statistical analysis is 0.02 –8 km. Table 5 shows the average distance (km) traveled by the households who do not own drinking water source to fetch during the off season.

WATER FOR BATHING

Survey data of year 2003 indicates among the households not having own source for bathing, the average distance traveled to bathe within season is about 0.816 km. This is a considerable distance.

Average distance traveled to bathe by households not having own source for bathing during the off season is high (1.917km) in Kirindi Oya. This is fairly a very long distance to travel. The time spent for this may badly affect the time allocation for agricultural purposes.

Seasonal variation of rainfall and inflow is indicated in Fig 2. It shows similar pattern of change both during rain fall and inflow. During the months of January, February, March and December, the difference between two lines are high. Hence relationship between these two parameters will be discussed in next section for Maha and Yala seasons.

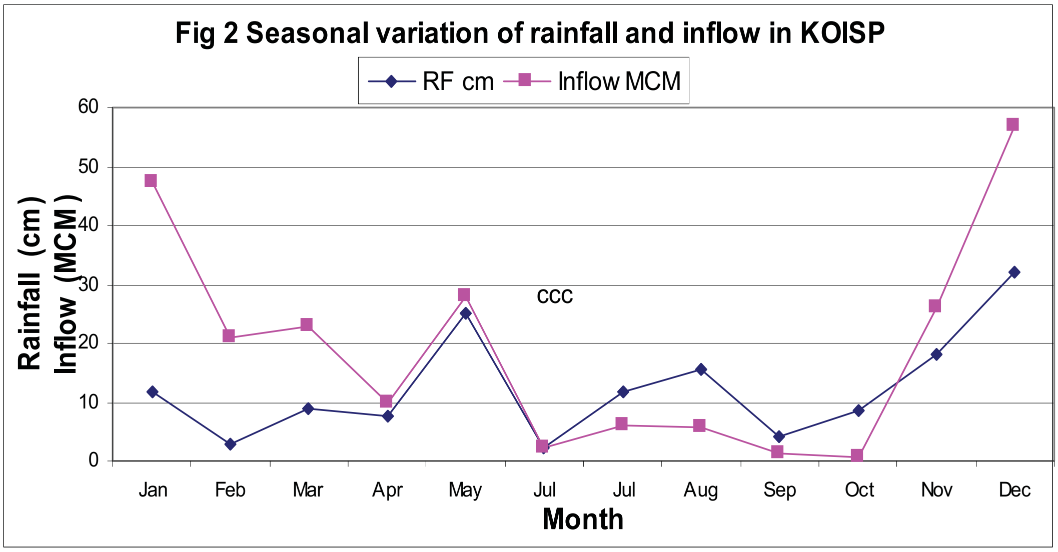


Figure 3: shows relationship of rainfall (mm) and inflow (MCM) during *Maha* season. Relationship between monthly rainfall and inflow of the KOISP was analyzed using simple regression analysis. It shows the inflow (IF in MCM) and rainfall (RF in mm) by the following equation (N = 24, R = 0.6104).

IF = 3.617 + 0.150097RF----------------------- (1)

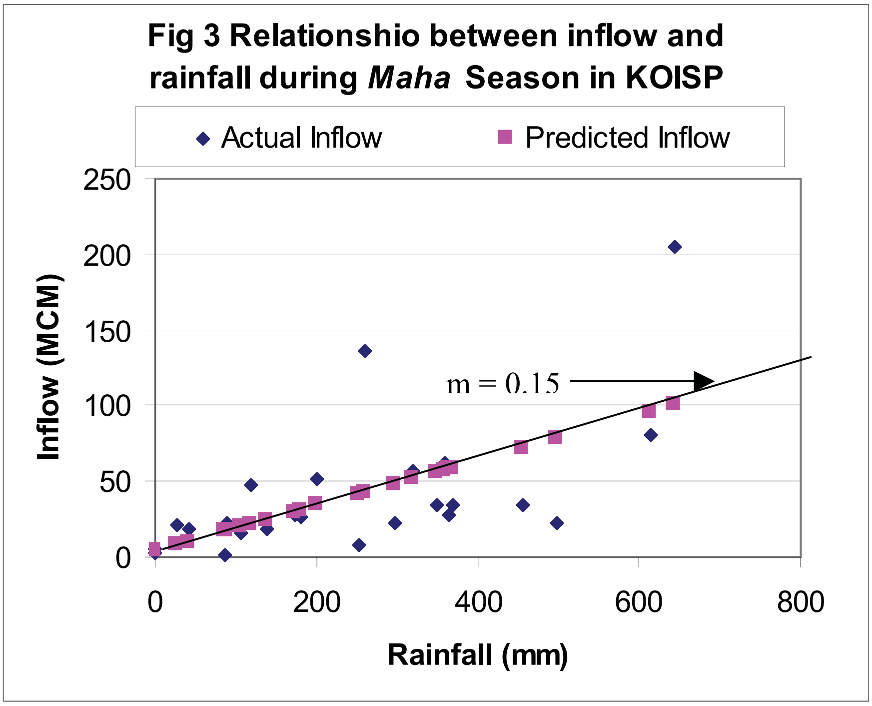
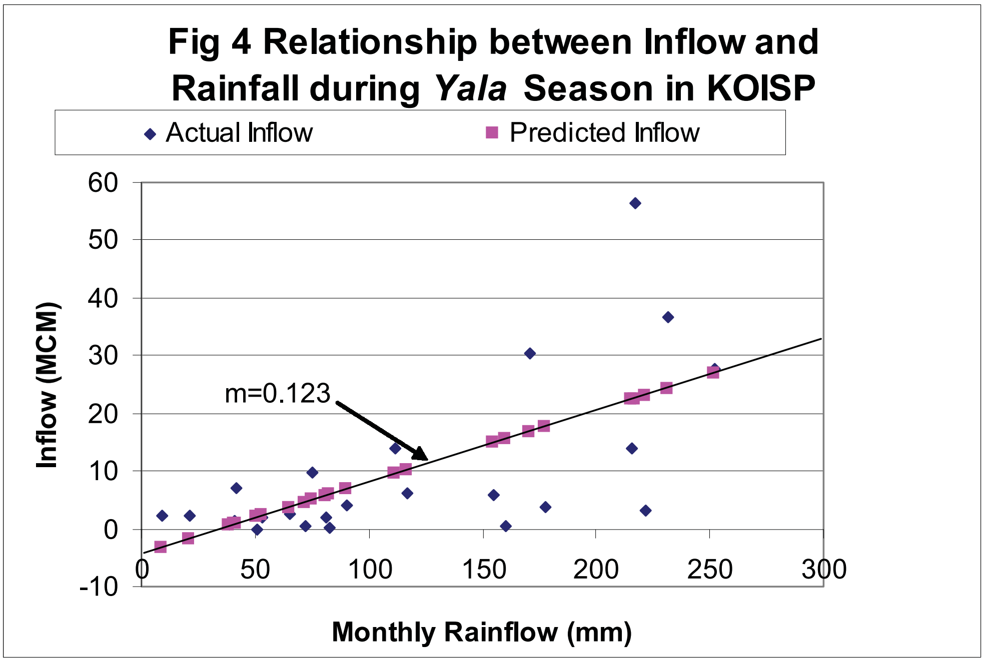


Figure 4: shows the relationship of rainfall (mm) and inflow (MCM) during *yala* season. Relationship between monthly rainfall and inflow of the KOISP was analyzed using simple regression analysis. It shows the Inflow (IF in MCM) and rainfall (RF in mm) by following equation (N=24, R= 0.6495)

IF = -4.399 +0.123196RF----------------------- (2)



Changes in performance due to changes in water-delivery strategies

According to Table 3 head, middle and tail end of the channel in the EIS reached nearly similar percentage of farmers. But in other two schemes (LB and RB) the farmer distribution was different along the field channels. Also there are 46% of tenant farmers in EIS but no any such farmers in other schemes.

Table 3: Breakdown of the surveyed farmers according to the schemes, location with respect to the field channel, tenure system and soil type of the farm

General information	Composition (number) of sample farmers							
	LB		RB		Old EIS		Total	
Total number of farmers	31		50		76		157	
Location with respect to the field channel	N	%	N	%	N	%	N	%
Head	6	19	21	42	24	32	51	33
Middle	13	42	12	24	24	32	49	31
Tail	12	39	17	34	28	36	57	36
Tenure system Owner	26	84	48	96	31	41	105	67
Lessee	5	16	2	4	10	13	17	11
	0	0	0	0	35	46	35	22
Soil type Can retain standing water	21	68	28	56	60	79	109	69
Cannot retain standing water	10	32	22	44	16	21	48	31

Source IWMI 2001

WATER DELIVERY: FARMERS PERCEPTION

Almost all the sample farmers were aware of the decision taken at the PMC meetings on the water delivery schedule (Table 4). It is estimated that the LB and RB farmers have experienced significant delays in water delivery from the agreed date of water delivery. It was also observed that the non-land-owner farmers have reported a significantly higher delay in the commencement date of water delivery, than the land owner farmers.

According to Table 8 the highest percentage of water is received by EIS. If shows the understanding and participation of EIS farmers on participatory water distribution. But in other two schemes (LB and RB) the water distribution percentages were lower than that of EIS in all four stages after LP stage.

Table 4: Farmers knowledge of water delivery

Factor	Distribution among systems			
	LB	RB	EIS	KOISP
Farmers knowledge on the PMC decision on the water delivery schedule (%)	94	86	93	91
Delay in water delivery (average number of days between agreed and actual water delivery)	14	9	0	6
Continuous mode of water supply				
LP stage (%)	100	92	100	97
NS stage (%)	35	32	89	60
TS stage (%)	6	6	51	28
BS stage (%)	6	0	37	19
FMS stage (%)	3	0	31	16

Source IWMI 2001 LP- Land preparation; NS – Nursery stage; TS – Tillering stage; BS – Booting stage; FMS – Flowering and milking stage

CROPPING INTENSITIES OF LUNUGAMWEHERA SCHEME

The cropping intensities of Lunugamwehera Scheme is given in the Table 5. It shows cropping intensity increases after 1990 especially in the new area. Due to less rainfall some years 97/99 and 200/201 low cropping intensities indicated in NIS.

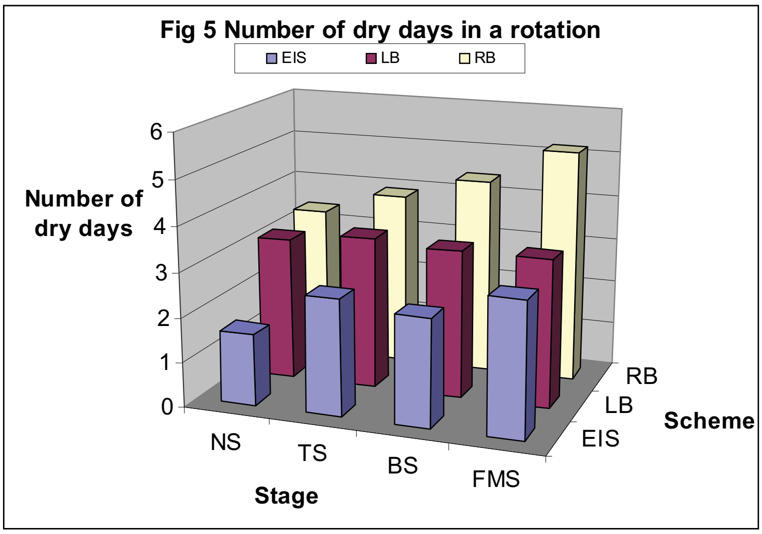
Table 5. Cropping Intensities of Lunugamwehera Scheme

Year	Old Area Cropping Intensity	New Area Cropping Intensity
87/88	2	1.25
88/89	2	1.14
89/90	2	0.45
90/91	2	0.85
91/92	2	0.98
92/93	1.6	0.94
93/04	2	0.81
94/95	2	1.63
95/96	1.7	2
96/97	2	2
97/98	2	1
98/99	2	0.74
99/00	2	2
00/01	1.38	0.74

Source: Irrigation Department 2004 Weheragala Reservoir Project

NUMBER OF DRY IN A ROTATION

The average number of dry days in a rotation is high in the RB and the very low in the EIS. Number of dry days in booting, flowering and milking stages in the RB was higher than the other two schemes. The Fig 5 shows lower number of dry days in EIS old area. That is also due to their participatory irrigation management.



LP- Land preparation; NS – Nursery stage; TS – Tillering stage; BS – Booting stage; FMS – Flowering and milking stage

PADDY YIELD IN KOISP

Paddy yield in the study area indicated in the Annex Fig 1. It shows high yield in the old area than other two areas. More farmers in the old area got more than 6 t/ha and most other farmers in the area got more than 3.75 t/ha. But most of the farmers of LB and RB received less than 1.37t/ha. This is mainly due to bad water supply for the crop.

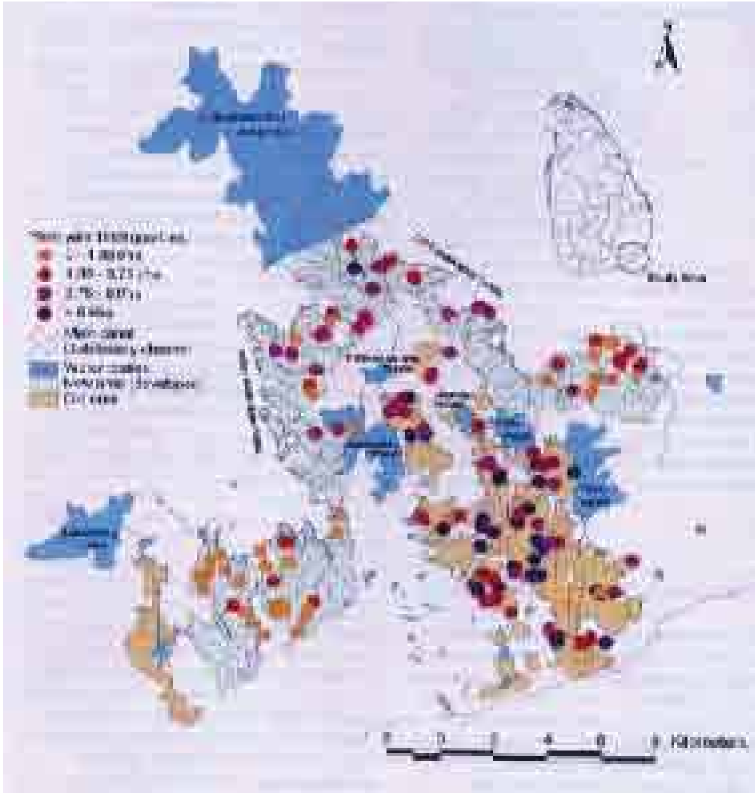
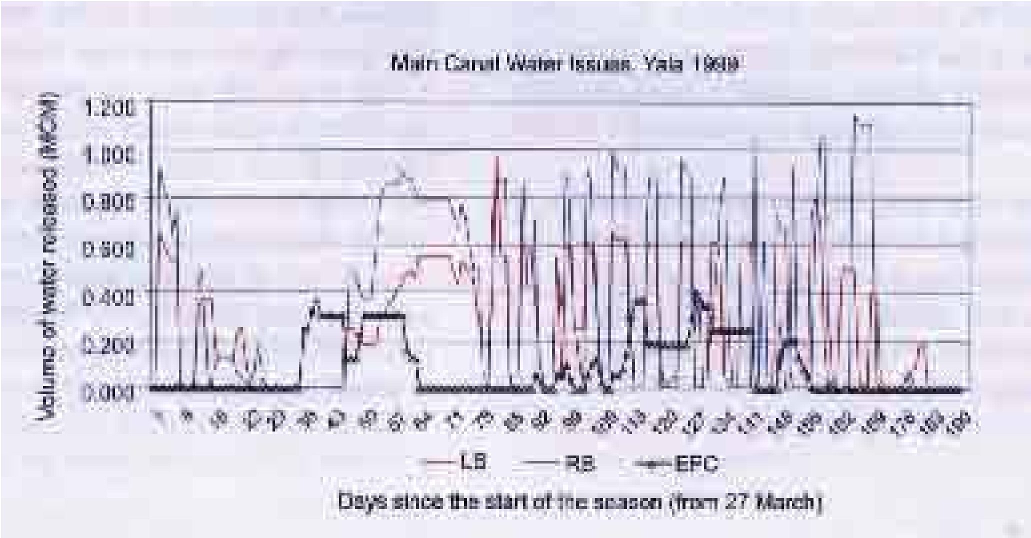


Fig 6 Spatial distribution of yield in the 1999 *Yala*: Kirindioya irrigation and settlement project

Source: Sakthivadivel, R, et al 2001

CONCLUSIONS

Due to high participation of EIS the farmers get less number of dry days and they reported that they received more than 71% adequate water delivery in all crop growing stages and a high yield ranging from 3.9 to 7.7 ton/ha. Due to less participation and other reasons the farmers in the RB of NIS reported 36%, 24% and 10% adequate water supply in tillering stage, booting stage and flowering stage respectively and obtained less yields ranging from 0.6 to 3.2 ton/ha. Due to less participation and other reasons the farmers in the LB of NIS reported 42%, 45%, 42% and 39% adequate water supply in nursery stage, tillering stage, booting stage and flowering stage respectively and obtained less yields from 1.8 to 4.8 ton/ha. This shows that the participatory irrigation management is important to optimum utilization of water resources and to gain high yield and income.



REFERENCES

1. Gamage, D., Wanigaratne, R.D., Wijetunga, L.D.I. and Tudawa, I. , 1988 ARTI research study No 85Kirindi Oya Irrigation and Settlement Project, Mid Project Evaluation
2. Irrigation Department 2004 Weheragala Reservoir Project proposal
3. IIMI. 1995. Kirindi Oya Irrigation Settlement Project: Project impact evaluation study. Vol.I: Main report (final) Colombo, Sri Lanka: IIMI. xxiii, 118p.
4. Ministry of Agriculture, Irrigation and Mahaweli Development, 2006 Draft National Water Resource Management Policy
5. Sakthivadivel, R.; Loeve, R.; Amarasinghe, U. A.; Hemakumara, M. 2001. Water scarcity and managing seasonal water crisis: Lessons from the Kirindi Oya Project in Sri Lanka. Colombo, Sri Lanka: IWMI. v, 29p. (IWMI research report 55)

USER PARTICIPATION IN MAIN CANAL GOVERNANCE

Herath Manthrithilake[1]; Sandjar Djalalov[2]

INTRODUCTION

The Soviet Union has built-up a massive irrigation system in Central Asia, between two main rivers, Amy Darya and Syr Darya rivers draining into Aral Sea. This irrigation system, one of the largest in the world, covering 9.1 million ha, was primarily providing cotton for the Soviet Union. Apart from cotton, wheat, rice, and orchards were providing much needed food and fibre for the locals. The large farms called 'Sovhoz' and 'Kolhoz' were owned and managed by the government and produced government's quotas of cotton and grains. Water management authorities, based on administrative districts were responsible for the delivery of water to the farm boarders. Within the farm water and other input management was done by the specialized groups –"brigades" of the farm under a Director. Hence, the water management authorities had only few bulk clients as water users and managed only the main and secondary canals. Water in third and forth order canals which were within the farms were managed by the farm authorities. The O & M works of the systems too, managed with the same accordance.

With the dismantling of the large government owned farms along with land reforms, thousands of smallholders, owning from fragment of a hectare to hundreds of hectares hanged onto those tertiary and lower level canals. They do grow cotton, wheat, fruits, vegetables, and variety of other crops in these plots. However, in most countries, still cotton and wheat are favoured by the farmers and in Uzbekistan, these crops are mandatory. Along with land reforms, water sector reforms too, have taken place. Kyrgyzstan was first to introduce Integrated Water Resources Management (IWRM), water fees, land alienation and established Water Users Associations (WUA), as early as in 1996. Unlike Kyrgyzstan, the Uzbek government still provides services and subsidies to agricultural producers. The organization and management of these services follow the old soviet style centrally planned and controlled systems with very limited or no participation of private sector. Although irrigation services are free of charge, the Uzbek government recovers its irrigation costs and other subsidies through setting prices for wheat and cotton (main cash crops) very low (ADB, 2005). In 2005, Uzbekistan has ordered converting all cooperative farms known as "Shirkaths" to Water User Associations. Irrigation service fees are introduced and pilot tested in few such WUAs in all districts of Uzbekistan. In Tajikistan, reforms were affected by the civil war,

1- Head, IWMI Central Asia Office, Apt. 123, Dom 6, Murtazaev St, Tashkent 100000, Uzbekistan.
Tel: (998-71) 1370445, Fax: (998-71) 1370317. h.manthri@cgiar.org
2- Regional Water Program Manager, Swiss Cooperation Office Uzbekistan, 15 Ivleva Str. Tashkent. 700100 Uzbekistan. Phone: +998 71 1205455 Fax 1205456 sandjar.djalalov@sdc.net

which started soon after the independence. Since the end of the civil war, - the late 1990s, the government has pursued liberal policies and the economic growth has been reaching 10.2 percent in 2003 (ADB, 2004). Tajikistan has set a price for irrigation services. However, it is still runs with large government farms along with small private farms, which makes the WUA operation a miserable activity.

It is worth to mention here that the intensity, pace and objectives of the reforms varies from sector to sector and country to country. In general, although institutional reforms in Uzbekistan are not commenced as rapidly as in other countries in Central Asia, their implementation has been rapid (Pomfret 2003). On the contrary, in Kyrgyzstan and Tajikistan though the policy reforms were fast, the implementation of the same is lagging and weak.

In the above-described setting, "Integrated Water Resources Management in Fergana Valley Project[1] (IWRM – FV) along with the support of Water Departments of Kyrgyzstan, Uzbekistan, and Tajikistan started water sector institutional reforms as part of promotion of IWRM principles. This exercise based on intensive social mobilization at all levels and these institutional reforms are much wider than normally used in WUA creation approach. Below the WUAs farmers are organized into Water User Groups (WUGs) along tertiary canals and above WUA, those WUAs are federated to participate in main canal management. This paper describes how users are involved in canal management and impact of that user participation on the performance.

In the past, during the Soviet times due to strategic importance of the main crops grown -cotton and wheat, Moscow had an eye on the irrigation system. Then these countries, called 'Republics of the Soviet Union', had to adhere to policies set by the Moscow. Hence, all the water systems including the reservoirs with hydropower stations operated with an irrigation bias policy set by the Moscow. Institutionally, agriculture being the largest and the most important water user, one local Ministry handled both the subjects – agriculture and water management. Ministries had water management run along the admin district base or "Oblast" (in Russian). Each Oblast had several sub-districts called "Raigion" (in Russian). These sub-district water management organizations called "Raivodhoz" were responsible, for all activities related to water management within the raigion. Most of main canals are so long that they cut across not only several sub-districts but also several Districts. Main canal, passing through a particular sub-district was managed by the relevant Raivodhoz. The raivodhoz controlled not only the outflow from the canal to the users but also the transit to next section belongs to the adjoining raivodhoz. Hence, the raivodhozes at upper reaches had the advantage against the lower ones. Often this has led to conflicts between the raivodhozes as de-facto 'users' of water to fulfil the region's own agricultural plans and promises towards the government. So, the upstream/ down stream conflicts were common at district and sub-district levels, and even between provinces. The issue was mainly the tail-end water supplies.

The operations of these multitudes of canal sections were coordinated by a central unit called "Dispatcher Point", which subsequently linked to Basin management and the Water Department. However, this dispatcher could not resolve conflicts as it did merely

1- IWRM FV project funded by Swiss Development and Cooperation, implemented in the Fergana Valley of Kyrgyzstan, Tajikistan and Uzbekistan by International Water Management Institute (IWMI) with Scientific Information Centre (SIC) of Interstate Committee on Water Coordination (ICWC) of Central Asia.

the monitoring part. With the advice of Basin organization on availability of water in the river system, the ministries used to set “limits” on water use for that particular year. Often the heads of oblovodhozes or raivodhozes interfered with the water distribution, which was again outside the ‘accepted plan’ and led to more obscure distribution. Though the ‘limit’ is normally lower than the ‘planned’, the ‘actual’ water use sometimes exceeded even the ‘planned’ due to such interferences.

In the past, water users were huge government owned farms. Hence, Raivodhoz has delivered water up to the farm gate and there upon, it was the responsibility of the irrigation “brigade” of the farm. Every year, the farm would provide the cropping plan according to the production quota assigned to them by the state. Raivodhoz used these proposed cropping plans to develop ‘water use/ demand plans’. Irrigation water requirement was determined for 10-day intervals (decade) based on crop type, sown area, soil characteristics, ground water depth and other environmental factors of irrigated areas. Based on these estimated requirements, Raivodhoz has scheduled and delivered the water. The Raivodhoz had a firm grip over the delivery of water to the farms and water conflicts between the farms were rare, but occurred. However, more frequently conflicts occurred between Raivodhozes themselves.

THE PROBLEM

With the land reforms introduced, independently managed farm sizes have become much smaller and privately owned. As the result, number of farms too increased from few numbers to several thousands. The farm gates moved from main and secondary canals to lower level canals. Now, thousands of smallholders hanged onto smaller canals, which have almost no regulating structures and asking water in different quantities at different times. The job of Raivodhozes has become more complicated and overloaded the existed capacities. Large numbers of overlapping requests from numerous smallholder farmers for smaller quantum of water for different crops, and the efforts to make water delivery schedules using existed method resulted in chaos, inequity, and unreliability at all levels of the irrigation water management. This has also led to a mismatch between water supply and actual cropping needs, waste of water and an exponential increase in the number of water-related disputes. The operations were further aggravated with the non-existence of proper canals and structures linking to individual farm holdings, while the main irrigation supply and drainage networks too are in a dilapidated state, due to decades of financial problems.

Under the influence of the technical assistance rendered by the international organizations, newly independent countries of Central Asia started creating a new institutional structure at farm level - Water User’s Associations (WUA) for water management. In ideal situation, WUAs could have effectively replaced the former “irrigation brigades” within farms. However, new small holder situation and absence of technical know how within newly created WUAs could not make this replacement effective. As mentioned earlier, the first WUAs in Central Asia appeared in 1996 in Kazakhstan and Kyrgyzstan, where the legal base for such activity was created. In Tajikistan, farmer cooperatives under took the water distribution role. In Uzbekistan, where agriculture reform proceeds in step wise, a new type of ‘independent cooperative farm’-“Shirkat” were created in place of old government farms, and the experiments with WUAs has begun in 1999. However, only in 2003, state water policy simultaneously with creation of basin management systems, acknowledged the creation of WUA as a step in reforms. In all five countries, WUA movement is now getting the momentum. However, again the progress is small and at different paces. WUAs created with the initiative ‘from above’ are regarded and operate as something similar to former Kolhoz and Sovhoz (old state owned farms), with a different name board.

With the adoption of IWRM principles, the ‘oblovodhozes’ were reorganized as “Basin Irrigation System Management Organizations” (BISMOs) and parts of the main canal sections, which came under ‘raivodhozes’ were regrouped as “hydroychastok” (in Russian) or “hydro units”. The coordination, which was carried out by the centralized dispatcher unit came defunct.

Despite these multiple fragmentations and worsening ground situation, the water management authorities continued to operate the way they used to do. The result being, almost all canal outlets left open to let water continuously flow without any regulation. Consequently, users in the upper reaches of canals have enjoyed the access to more water at the cost of the tail-end water users, and small fields fill up quickly and surplus water discharged to the drainage network, while bigger plots never irrigated fully throughout the season (IWMI, 2004). Hence, over use, deficit, water logging, salinity, etc, were haunting every corner of this huge system, which has led to low yield, poverty and other livelihood issues.

In summary, the main question was how to serve the multitude of farm holdings in an equitable, uniform, justifiable, and sustainable way, so that user conflicts are minimized if not eradicated, and transparency and fairness maintained through out the network, despite all structural ills encompassed. The WUAs and Water User Groups (WUGs) set up through bottom up approach are solving these problems effectively. The issue is how to make sure that the trust placed on the WUAs sustained. For this WUA should have uniform and reasonable supplies of water. For this purpose, main source of supply – the main canal has to function in an appropriate way. How to improve the operations of the Canal?

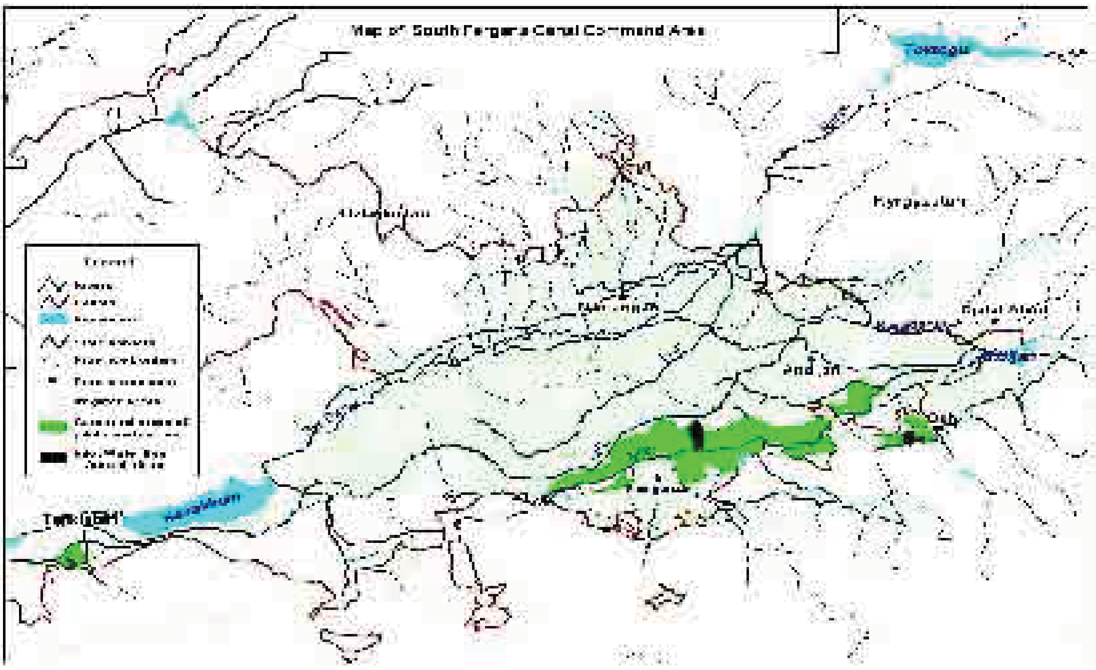
HYPOTHESIS

Experience elsewhere suggests that effective water delivery in situations like these can only be achieved by fostering greater participation of users in the process of planning and distribution of water (Abernethy 1988; Horst 1990). Involving water users in the planning and distribution processes requires participatory approaches and methods that are user-oriented, as well as simple enough to be understood by farmers. This kind of user involvement can achieve only through a thorough social mobilization or creation of good awareness on the role and responsibilities of the users. The world has lot more experience of setting up Water User Associations for smaller systems. The hypothesis here is that similarly, users’ participation in main canal management would improve the performance of the canal operations.

EXPERIMENT

The Ferghana Valley is considered as the oasis of the Central Asia (see Map 1). This valley forms the upper to middle reach of the Syr Darya River Basin, where three quarters of the river's run-off originates in Kyrgyzstan. This area of highest productivity is shared by three countries, namely, Uzbekistan (71 %), Tajikistan (8 %) and Kyrgyzstan (21 %). This valley consist of 49,000 km² in total (5% of the Central Asian territory) is home for 27% of Uzbekistan, 31% of Tajikistan and 51% of Kyrgyzstan population. The total population of the valley is about 10.5 million, makes more than one-fifth of the Central Asian population. Thereby this area contains the highest density of population (250 people/ km² compared to that of 14 people/ km² for Central Asia on average. The Valley has a number of most extensive and economically important irrigation systems in Central Asia. Due to these reasons, this project mainly aimed at water sector institutional reforms was located in this area. Therefore, the Project Steering Committee has selected three main canals for pilot testing from each country (Annual workshop, 2002). These canals are:

1. **South Ferghana Canal** (SFC) in the Ferghana Province of **Uzbekistan**;
2. **Aravan Akbura Canal** (AAC) in the Osh Province of **Kyrgyzstan**;
3. **Khodja-Bakirgan Canal** (KBC) in the Soghd Province of **Tajikistan**



Map 1. Fergana Valley and three pilot Main Canals

Characteristics of these canals are given in *Table 1.* These long main canals in Central Asia are continued to be managed by dividing them into sections based on admin region. For instance, South Fergana Canal (SFC) came under eleven raivodhozes. The other two relatively smaller canals had two raivodhoz per each.

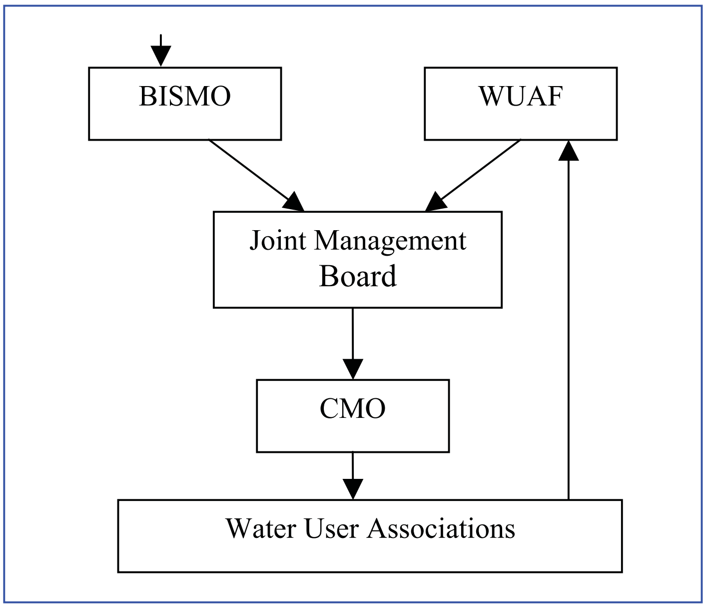
Tab. 1 Canal Characteristics

Name of the Canal	**Length (km)**	**Head Discharge (m3/Sec)**	**Command area (ha)**
South Fergana Canal (SFC)	137	100	83,884
Aravan Akbura Canal (AAC)	37	25	9,200
Khoja-Bakirgan Canal (KBC)	31	33	8,100

With the efforts of IWRM-FV project, a single Canal Management Organization per each canal was formed. Canal is no longer in the hands of several admin units but managed as a one whole unit under a Chief Engineer. These new Canal Management Organizations (CMO) are now responsible from head to tail of the canal, without any interventions from oblovodhoz or raivodhoz. Thereby the political interferences over the fragmented canal management have been stopped.

The next important step was to involve stakeholders in the management of the canal. A governance body, - type of a 'managing board' were formed with stakeholder participation for each of them. This is a novelty in the whole Central Asia and perhaps in the whole ex-soviet countries. Understanding of this concept - managing such an important economic unit with *stakeholder participation,* was initially difficult for many in the water management authorities here. Hence, there was a huge reluctance and suspicion on the proposed system on the part of authorities. There were difficulties in understanding and separation of the roles of 'governance' & 'management'. A 'government paid canal manager and his staff' could not be "*supervised"* by a "non-governmental body". Further, there were legal obstacles to overcome, as it was illegal to transfer government funds into the hands of a non-government body for operations and maintenance of the canal. Compromise was reached by setting up a '*joint management board*' with representatives of both BISMO[1] and User Federations according to the financial contributions they make towards the operations of the Canal. After a long discussion and dialogues, in December, 2005 Kyrgyz Water Department agreed to authorize a 'joint management' to run the CMO. The new management structure is shown in the Diagram 1.

1- BISMO is the same Oblovodhoze renamed under the basin management concept as Basin Irrigation Management Organization.



Diag. 1. Management model

With this approval from Water Ministry of Kyrgyzstan, for the Aravan Akbura Canal management and governance functions were separated. The day-to-day management is handed over to the professional staff of the Canal Management Organization (CMO), while policy making over the CMO was passed on to an independent governance body consisting members of BISMO and Water Users Associations Federation (WUAF). The BISMO and other water authorities agreed not to interfere with the decisions of the governing board. Also, the governing body has to operate within the laws of the country and can make policy decisions pertaining to finances and water distribution only within the canal command area.

WUAs along the canal and other stakeholders are federated into a single organization (WUAF) and representatives of this federation are now sits on the new canal governing body, along with the government representatives coming from BISMO. The membership quota for this governing body is divided according to the financial contributions make by of each party to the operations of the CMO. In Aravan Akbura governing body there are four members representing BISMO (government) and WUAF is represented by three members. The CMO chief is a non-voting member of this governing body. Chair of the 'Joint Management Board' (JMB) is elected by voting from the board members. This governing body now successfully oversee the policies and functioning of the CMO of Aravan Akbura Canal.

Above management structure was selected by the stakeholders of the AAC out of three options to them by the project. Similarly, work is going on to select the form of management for other two canals too.

The situation with regards to South Fergana Canal (SFC) is not matured as of AAK. The situation at SFC is more complex. Form of user representation is just being agreed upon and legal recognition is yet to come for this users Federation. The documents are with the Ministry of Justice for registration. The CMO has taken over the control of whole length of the canal including several major structures. Despite of these difficulties, users have already taking part in the operations of the canal. Yet to be 'registered' canal governing board is currently chaired by a woman water user and influence of the board is already showing results.

In Tajikistan, the HBC CMO is already functioning and collecting water fees. The WUAs are just getting into their places and it is too early to federate them. However, already a stakeholder committee is informally overseeing the CMO of KBC. Despite, technical and legal shortcomings, the canal governing bodies started to 'informally' function from December 2005 and showing positive results.

RESULTS & DISCUSSIONS

The impact of project interventions on the canal performance is vital in many perspectives. Failure could tantamount to many repercussions for the future user participation in water management. However, the success too can have great impacts on these irrigated agriculture based economies as a whole. Therefore, it is important to measure the impact of these interventions. There are many ways to assess the impact or performance of an irrigation system (Bos et al. (2005), Small and Svendsen (1992), Wolters (1992), Murray – Rust and Snellen (1993), Bos et.al. (1994). More advanced systems like 'benchmarking', was designed to compare performance across systems, within defined contexts (IPTRID/WB/IWMI).

The main performance indicator used in this study is Delivery Performance Ratio (DPR), which shows changes in quality of services provided by the canal management and quantifies the uniformity and equity of water delivery. DPR is calculated as the ratio of actually delivered volume of water against the planned. The Delivery Performance Ratio (Bos et al. 2005), indicate the quality of services to water users, which is quantified through the ***uniformity*** and ***equity*** of water delivery. The ***uniformity*** is measured as the temporal change while the ***equity*** is measured as spatial variability of DPR.

$$\mathbf{DPR\ (T, S) = W}\ \boldsymbol{actual}\ \ \mathbf{/\ W}\ \boldsymbol{planned} \qquad (1)$$

Where, **DPR** – delivery performance ratio

W *actual* – actual water delivery in the diversion point in a given decade (cubic meters)

W *planned* – planned water delivery in a given decade (in cubic meters)

According to FAO (1986) classification the following three levels of DPR is distinguished:

- **deficient** water distribution (when **DPR< 0.8**)
- **moderate** distribution (**0.8<DPR<1.2**) and
- **excessive** distribution (**DPR>1.2**)

This paper shall use these two criterions (***uniformity*** and ***equity*** of water delivery) to assess the impact of interventions on the canal management.

The data used for this purpose is picked-up from the canal operators' reports and assumed they are accurate and represent the real situations. This data has been collected during the period of 2000 -2005. The IWRM Ferghana project started in 2002 and continues promotes institutional reforms to date. Water deliveries were measured 3 times a day. Daily averages were calculated based on arithmetic averages of the measured water deliveries.

The existing seasonal planning system in Central Asia is based on 10-day periods (called a 'decade'). Each month is divided into 3 decades. The irrigation season lasts from April to September, with a total of 18 decades. For the purposes of this study, actual decadal water deliveries were compared against the planned decadal water deliveries over the full or part of the irrigation season of study periods (2000-2005).

Descriptive statistics of spatial variations of DPR by Water User Associations (WUA) before interventions 2003 and post interventions (2005) are also given in *Tab. 2* in head to tail order This table indicates that project interventions has made significant impact. Only the first half of the vegetation periods, where first crop is cultivated has being used in this table and figures. This is just due to processing and computerizing delays of the data from the original sources by the time of preparing this paper and not for any other reasons. The averages of the water distribution coefficients of the Aravan Akbura Canal (AAK) for two periods are 0.49 and 0.97, respectively. The temporal distribution shows that compared with 2003, DPR remained within the moderate water distribution range ± 20% of the planned (between 0.87 and 1.16) through out the season 2005 (Tab 2.), whereas this was achieved only once (0.17 - 0.90) during 2003.

Tab. 2. Spatial and temporal distribution of DPR for Aravan Akbura Canal, Kyrgyzstan

Location	**Year**	**April**			**May**			**June**			**MEAN (3 Months)**
WUA Name	**2003**	**1**	**2**	**3**	**1**	**2**	**3**	**1**	**2**	**3**	
"Japalak"		0.27	0.24	0.29	0.41	0.49	0.31	0.70	0.52	0.56	0.42
"Jana Arik"		0.11	0.40	0.43	0.45	0.28	0.20	0.42	1.05	0.82	0.46
"Kerme-To"		0.13	0.20	0.22	0.22	0.92	0.45	0.68	1.07	0.87	0.53
Total AAK		**0.17**	**0.23**	**0.26**	**0.30**	**0.73**	**0.39**	**0.67**	**0.90**	**0.77**	**0.49**
	2005										
"Japalak"		0.53	0.59	0.08	0.95	0.87	0.84	0.41	0.33	0.35	0.55
"Jana Arik"		0.94	0.61	0.13	0.87	1.01	0.91	0.67	0.70	0.60	0.72
"Kerme-To"		0.29	0.64	1.20	0.39	1.30	0.71	0.90	0.87	1.04	0.81
Total AAK		**1.16**	**0.99**	**0.98**	**0.89**	**0.89**	**0.87**	**1.01**	**0.92**	**1.03**	**0.97**

For visualization purposes, this information is presented in the *Figure 3a & 3b***.** The *Fig. 3b* shows improvement of *equity* among the users. It is important to note that Japalak WUA is using more than stated amount of water due to reuse of drainage water from other users. Japalak management is of the view that they are accountable (should pay) only for the water received from the supply canal and not for the water taken from drainage canal. Hence, records indicate only the irrigation canal supply. However, during the personal discussions, the Japalak management accepted that the situation has improved drastically since, 2003 with user interventions in the canal management.

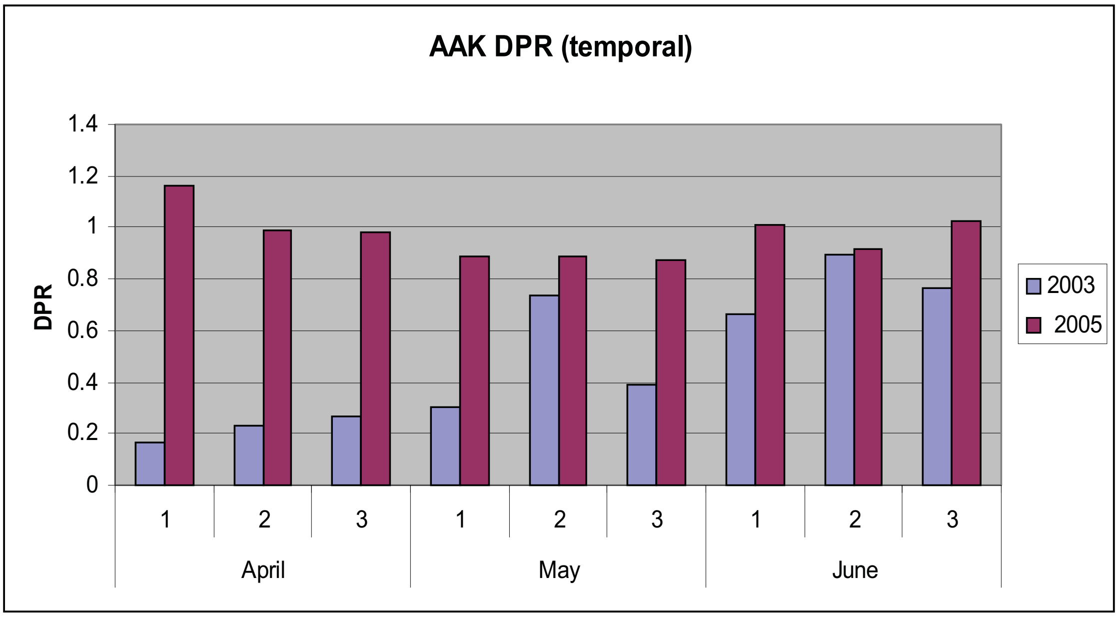


Fig. 3a. Temporal distribution of DPR of Aravan-Akbura Canal pre intervention (2003) and post intervention (2005) periods

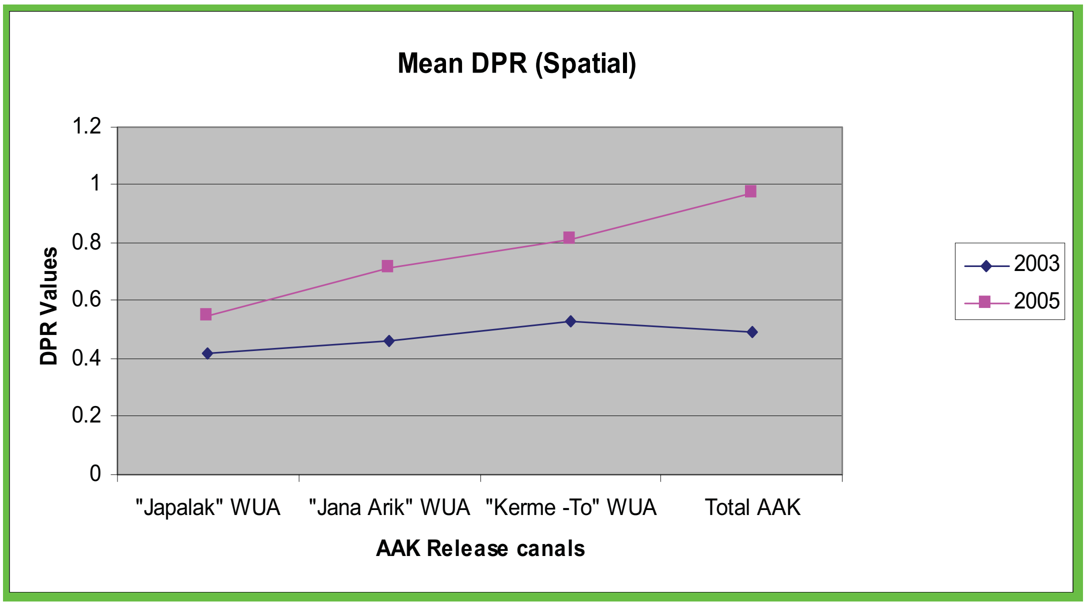


Fig. 3b Spatial distribution of DPR of Aravan Akbura Canal pre intervention (2003) and post intervention (2005) periods

These are clear indications, where users influence on the operation of the canal. They got the canal management to operate at least close to the agreed plan. Of course these are just first ever experiences in the users participation in canal governance. Both the parties, users as well as canal managers have to get used to 'each others', the new situations and be responsive to the hydrologic situations. These improvements within first two years indicate that the direction of change is correct. The new 'canal governance body' is now taking appropriate actions to improve the fee collection rates to finance the infrastructure rehabilitations, which will make the management easy and more uniform and equitable. It is important to remember, that Aravan - Akbura Canal has being the most progressed canal in terms of legalizing and operationalizing the user involvement in canal governance.

The reforms introduced to SFC management, have a positive impact on water distribution. All 8 large hydro units of SFC, from which the water is now delivered to the primary water users i.e. WUAs indicates that there is a clear difference between the periods of pre and post reforms / interventions.

The following analysis was done by IWMI researchers (Iskandar, et al. unpublished (2006)). The band in (Fig. 4) shows the moderate water distribution with ± 20% of the planned. The actual distribution has remained close to this range since the intervention. The pre-intervention (2000 - 2002) period is characterized by over supply of water, even during the water shortage year of 2000 in Central Asia. During the intervention period there were two cases with extremely low DPR – 0.21 (September 2004) and 0.16 (September 2005). They occurred at the end of the cropping season (Fig. 4). Hence, did not have any impact on the irrigation water users but might have negatively impacted on non-agricultural water users.

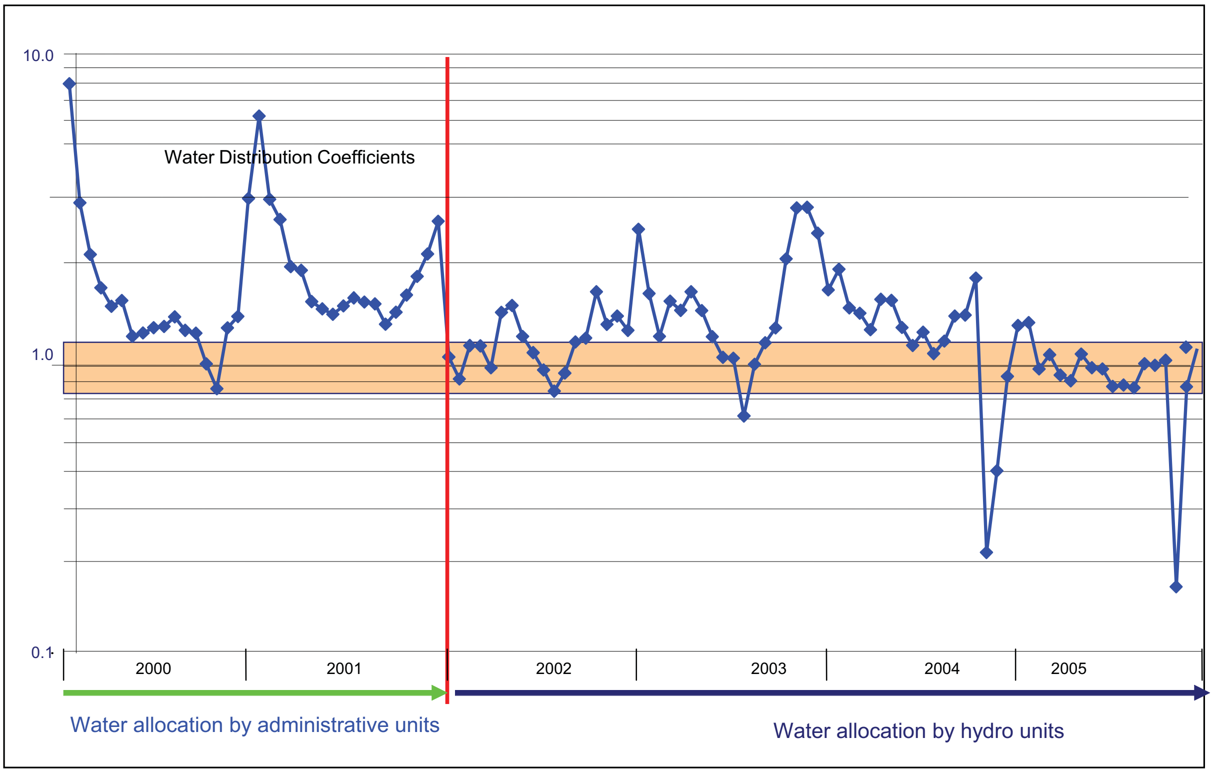


Fig. 4 Temporal variations of average water distribution coefficients (adopted from (Iskandar, et al. (2006)

The spatial DPR (equity) analysis of the pre intervention (administrative districts) and the project intervention period (hydro units) shows significant differences (*Tab. 3a &b*). The weighted averages of the water distribution coefficients for two periods are 1.97 and 1.2, respectively.

The mean DPRs for the pre-intervention period are relatively homogeneous, ranging 1.08-1.46 until the Kuva Raivodhoz (Ferghana), which is located at the middle of the SFC. For the Kuva Raivodhoz DPR equals to 2.52, Okunbabaev WMO again reduces it to 0.97 and then reaches it is highest values in Oltiarik, Fargona and Yozyovon districts - 2.23, 4.28, and 3.07 respectively. This indicates that the water distribution among the administrative districts located along the canal was not equal during the pre-intervention period. (See Fig. 4 also) However, the unequal water distribution did not result in impaired water delivery to the tail end districts. Rather, the tail end users received more water than planned.

However, the picture has changed to a more equitable distribution, as a result of the unification of the canal for the hydrographical management and the active role, which water users started to play in SFC through their representation in the Canal Water Committee (CWC). This is clearly visible in the Tab. 3b.

Tab 3a & 3b. Spatial distribution of DPR along the SFC in different periods

Tab 3a. Observation Period	Raivodhoz	DPR Mean Value
Pre intervention period 2000-2001	Khujaabod	1.46
	Bulakbashi	1.45
	Markhamat	1.44
	Aravan	1.72
	Kuva	1.42
	Tashlak	1.08
	Kuvasay	2.52
	Okhunbabaev	0.97
	Oltiarik	2.23
	Fargona	4.28
	Ezyovon	3.07

Tab 3b. Observation Period	Hydro units	DPR Mean Value
Post intervention period 2002-2005	Hydro unit 1	1.06
	Hydro unit 2	1.13
	Hydro unit 3	1.53
	Hydro unit 4	1.06
	Hydro unit 5	1.10
	Hydro unit 6	1.35
	Hydro unit 7	1.00
	Hydro unit 8	1.34

Canal is now managed as units/sections under unified management and not under admin area based. Hence the Fig. **5a** & **5b** has two different axis's. Nevertheless, spatial distribution has evened out, cutting down the excessive supplies to the users. In 2005 another revelation occurred. That is around 6000 ha of lands earlier unreported through the system but irrigated has being identified. However, Fig. 5b shows that there is more room for improvement on spatial distribution.

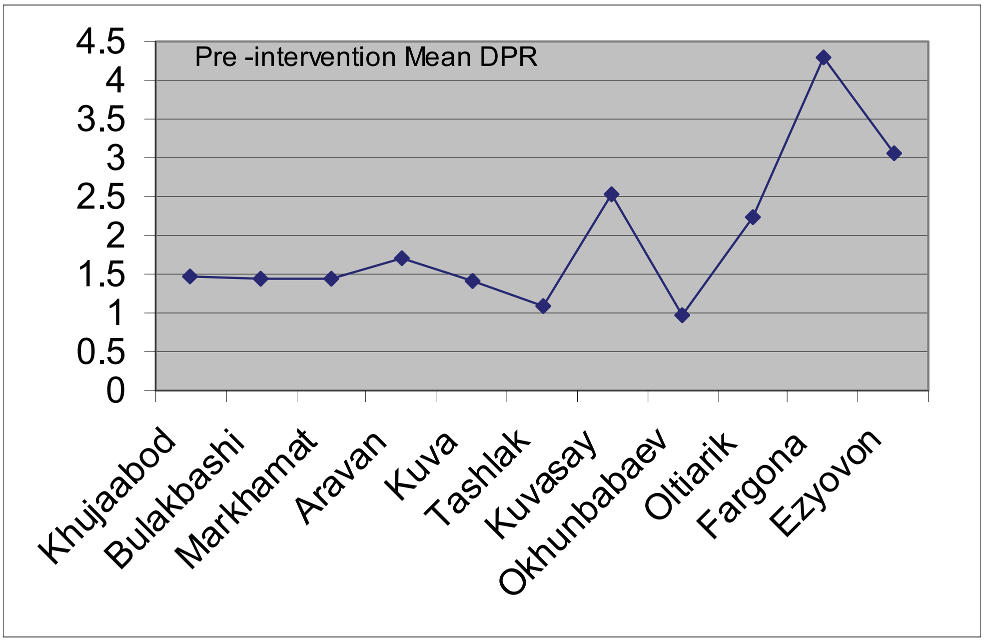


Fig 5a. Spatial distribution of DPR as per 2000

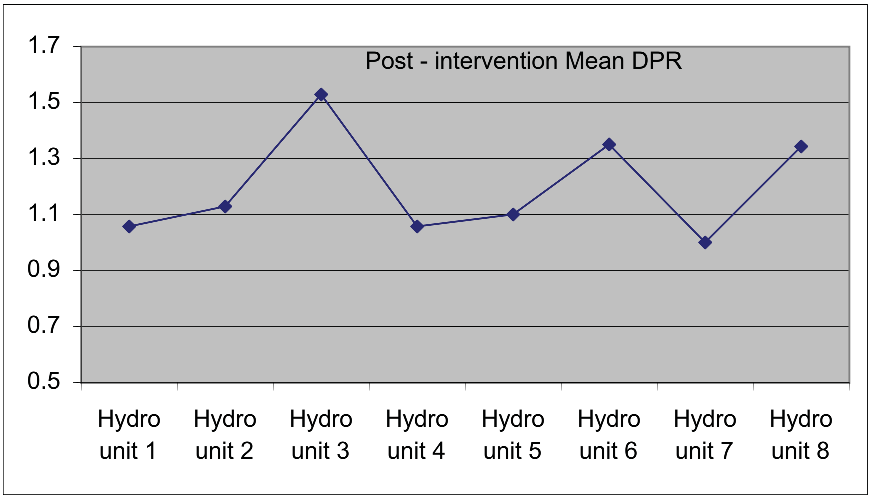


Fig 5b. Spatial distribution of DPR as per 2005

In 2000 - 2002, when the canal was managed territorially with no water user representation, water supply was excessive. Hence, the pre intervention period can be characterized by very high DPR both spatially and temporally, indicating the over supply of the water from the SFC. The overall water distribution performance during the intervention period can be measured as a moderate and in 2005 was mostly optimal. The pattern of spatial & temporal changes of water distribution clearly mirrors the interventions in SFC. The above analysis indicates that there have been improvements in the water distribution.

The data on Hoji-Bakirgan canal of Tajikistan were not ready for processing by the time of preparing this paper. There is no doubt that the situation there too, has being improved though legal aspects of user participation as in SFC is yet to be formalized. Moreover, along the total canal length there are still large old cooperative farms (kolhozes), which were yet to be dismantled. Some of the newly created WUAs are dependent on these cooperative farms for their water as the delivery canals are passing through them. Nevertheless, users are already making in roads to the Canal management.

CONCLUSION

It is obvious from the above analysis that canals management has improved its performance against what it was before the reform. The equity and uniformity of water distribution has improved with the users' involvement in the governance. DPR is reaching the levels of moderate distribution. There are other evidence like user fee collection rate, user satisfaction surveys, etc (though this information is not provided here) to prove that the reforms are on the correct path. However, there is more distance to go.

Managing the canal as hydraulically one unit and thereby created a fair and just distribution of available water between all sections of the canal. This has reduced the political and administrative interference on the operations of canal for water releases.

Involvement of users has brought two main advantages: a) users are contributing to much needed financial resources for the maintenance of the system; b) transparency of water availability and self-control of the users, which has being the root cause for admin interference and thereby reduced the conflicts.

We conclude that the reforms on canal management to include users' participation in all three countries have led to an improved performance (a reduction of excessive water delivery and increased the prevalence of moderate water distribution). Overall assessment of the situation for the pre- intervention and intervention periods shows that IWRM project interventions had a positive impact on equity and uniformity of water distribution.

REFERENCES

1. Abernethy, C.L. (1988). The concept of flexibility in irrigation systems. Paper presented at the Irrigation Management Conference, Wuhan, China
2. ADB (2004) Country Strategy and Program Update 2005-2006. Tajikistan.
3. ADB (2005) Agriculture Sector Review and Planning. Volume 1: Main Report. Current Status and Outlook for the Agricultural Sector.
4. Bos M.G, M.A. Burton and D.J. Molden. (2005) Irrigation and drainage performance assessment: practical guidelines. CABI Publishing. 158 pp
5. Bos M.G., Murray- Rust, D.H., Merrey, D.J., Johnson, H.C. and Snellen, W.B. (1994) Methodologies for assessing performance of irrigation and drainage management. Irrigation and Drainage Systems 7, 231-262 pp.
6. Burt, C.M and Styles .S (1997) Irrigation Modernization Study, appendix "Irrigation Indicators', Washington, DC: World Bank-IPTRID –IIMI.
7. DFID (2001) Sustainable Livelihood Analysis. Sustainable Livelihoods for Livestock Producing Communities in Kyrgyzstan
8. Herrfahrdt, E., Kipping, M., Pickardt, T., Polak, M., Rohrer, C. and Wolff C.F. (2005) Water Management in the Kyrgyz Agricultural Sector: On its way to IWRM? Final Report of the Country Working Group Kyrgyzstan. German Development Institute. Bonn
9. Horst, L. (1990) Interactions between technical infrastructure and management. Network paper 90/3b, Irrigation Management Network. London: Overseas Development Institute.
10. Institutional Reforms at Main Canal Level and its Water Management Implications: Case from South Ferghana Canal, Uzbekistan (unpublished 2006) Iskandar Abdullaev, Jusipbek Kazbekov, Herath Manthrithilake, Kahramon Jumaboev, Murat Yakubov
11. Integrated Water Resources Management in the Ferghana Valley. (2002) Institutional Analysis of Water Management in the Ferghana Valley. Project Document. Tashkent: International Water Management Institute, Scientific Information Center of the Interstate Commission for Water Coordination and Swiss Development Cooperation.

12. IWMI.2002. Integrated Water Management in the Ferghana Valley Project (IWMFVP) (WA 300701). Institutional Situation Analysis of Water Management in the Ferghana Valley
13. Mehmood, H., R. Starkloff and N. Nizamedinkhodjaeva. (2004). Inadequacies in the Water Reforms in the Kyrgyz Republic. An Institutional Analysis. Research Report 81. Tashkent: International Water Management Institute.
14. Murray – Rust, D.H and Snellen W.B. (1993) Irrigation system performance assessment and diagnosis. Joint IIMI/ILRI/IHEE publication International Irrigation Institue, Colombo, Sri Lanka.
15. Pomfret, R. (2003) Central Asia since 1991: the experience of the new independent states. Working papers no 212. OECD Development Centre
16. Resolution № 320 (21.07.2003) of the Cabinet of Ministers of Uzbekistan. 2003. «On improvement of organization of water management system», Tashkent, Uzbekistan
17. SDC. (2005) Integrated Water Resources Management Project in the Ferghana Valley. External Review of Phase II and Recommendations for Phase III. Final Report prepared by PA Consultant Services, Inc.
18. Small., L and Svendsen, M. (1992) A Framework for Assessing Irrigation Performance. IFPRI Working papers on Irrigation Performance #1. International Food Policy Research Institute. Washington. DC.
19. Wolters, W. (1992). Influences on the Efficiency of Irrigation Water Use. ILRI publication #51. International Institute for Land Reclamation and Improvement, Wagnigen, the Netherlands.

PARTICIPATORY APPROACH FOR MANAGEMENT OF WATER RESOURCES OF KATEPURNA SUB-BASIN IN MAHARASHTRA STATE

Dr. Sanjay Belsare[1]

ABSTRACT

Katepurna project is a major irrigation project in Katepurna sub-basin. Over the last 25 years, the project could utilise on an average 25% of its irrigation potential. The PIM approach has not only improved its irrigation utilisation, but also it has led to strong demand from farmers to reduce non-irrigation reservation and allocate water for irrigation. The amicable solution has been arrived at, as a result of fruitful dialogue among irrigation and non-irrigation users.

Now with the benefits of Katepurna project accrued to the farmers of Katepurna command, area that is mostly in Purna sub-basin, the farmers in Katepurna sub-basin especially just downstream of dam, were demanding benefits of the project. There was strong agitation by farmers to support their demand. Sinchan Sahyog, a NGO has come forward to bring representatives of stakeholders and users of sub-basin water resources on one platform. The dialogue between users and stakeholders is in progress. Sinchan Sahayog is working on development of better partnership among all stakeholders and users at sub-basin level. A plan will be prepared, with their participation, to make effective use of water resources in the sub-basin catering needs of stakeholders and users.

INTRODUCTION:

Katepurna River is a tributary of Purna River, which further joins Tapi River. The length of Katepurna River till its meets Purna River is about 127 km. The total area of Katepurna sub-basin is around 1194 sq. km. There are 195 villages in the sub-basin, with total population more than 0.3 million. The sub-basin has special feature with hilly region and dense forest in upstream while typical saline belt at down stream end. There is a major river project on river Katepurna near village Mahan. There are few minor irrigation projects in the sub-basin catering irrigation and water supply needs of nearby 2-3 nearby villages. The detail of Katepurna sub-basin is shown in Figure 1.

1 - Executive Engineer, Palkhed Irrigation Division, Water Resources Department, Government of Maharashtra

KATEPURNA IRRIGATION PROJECT

The Katepurna irrigation project is completed in year 1975. The project envisages irrigation supply to 8325 ha of land, water supply to Akola City and 53 villages in saline belt, where there is no alternative source of fresh water. The command area of project has mostly deep black cotton soil with 45% area falling in saline belt. The distribution network is of open unlined canal.

Katepurna project completed its 25 years of service in 2000, but the project couldn't provide the irrigation benefits as envisaged during project planning. In last 25 years, the project could provide irrigation hardly to 2027 ha. On an average.

The under utilisation of irrigation potential has prompted the government to reallocate water for non-irrigation use resulting in 54% water being reserved for non-irrigation use. It consequently resulted in proposing curtailment of command area of the project and reducing it to 5967 ha.

REASONS FOR UNDER UTILISATION

As project falls under assured rainfall zone, the farmers were not much enthusiastic towards irrigation. Secondly, reluctance among farmers was also due to non-assurance of getting right amount of water at right time. There was heavy wastage of water, which led to problem of drainage and transportation of produce from the command. There were outstanding dues on farmers and as a result the majority of farmers were not using the water. The department could not maintain the canal throughout the length due to less utilisation and shortage of funds. Under such circumstances, there was no co-ordination among beneficiaries and project authorities. Every one was blaming each other for under utilisation of water.

The Katepurna project was one of the worst affected projects in terms of under utilisation in the region. Other projects in the region are also having somewhat similar scenario. Considering this poor utilisation, efforts were made to analyse the situation and identify key areas. The remedial measures are strategically planned and implemented.

MEASURES TAKEN

ENGINEERING MEASURES

Initially, the system repairs were carried out by removing bottlenecks in the system and improving the system. Irrigation scheduling was observed strictly with tail enders to receive water first and head reach farmers at the end. Night irrigation was made compulsory. Due to disciplined distribution, it resulted into adequate and timely supply to farmers. Farmers were encouraged to adopt improved surface irrigation methods through demonstration.

AGRONOMIC MEASURES

Integrated approach of irrigation and agriculture at field as well as administrative level is adopted. Farmers were motivated to go in for crop diversification. Farmers started taking pre-monsoon cotton, followed by rabbi crop e.g. wheat. It resulted in higher yield of cotton. The farmers are also educated to apply water to crop at critical growth stages of crops instead of applying water frequently to crop.

MANAGEMENT MEASURES

Better and reliable, irrigation management and operation practice is followed, considering limitation of system and farmers' requirement. Better co-ordination among farmers and project authorities established at different level involving farmers in decision making and irrigation management of the project.

Awareness campaign conducted for formation of water user's associations (WUAs') and efficient use of water through all possible media available e.g. newspaper, radio, television, exhibitions, posters, cultural programmes etc.

With gaining trust of the farmers and with better services to farmers, the farmers started reacting positively to Irrigation Department's call. Farmers were motivated, trained and convinced about the importance of WUAs'. The privilege and incentives provided for formation of WUAs was explained to them. With initial success in participatory irrigation management (PIM), farmers responded by formation throughout the command of WUAs. The development in formation of WUA is shown in Table 1.

TRANSFER OF MANAGEMENT

Transfer of management to farmers is very important phase in PIM. Generally irrigation personnel are reluctant to relinquish the authority over the system and on the other side, farmers feel that they are burdened with the unwanted responsibility and they try to shrink it or pull on by one or other reasons. Earlier experience of WUAs was not encouraging and thus there was reluctance among WUAs for taking over. Initially, instead of running behind WUA to take over, efforts were made to concentrate on few WUAs and appraising them with concrete benefits of transfer. There was apprehension that once they take over, government will not pay attention towards them even to their rational demand and they will have to face the villagers for any conflict in management owing to condition of canal system. But with setting of initial successful example and seeing benefits accrued to them, WUAs came forward for handing over of management. Their footsteps were followed by other and transfer of management was took place on almost all WUA. The steady and convincing approach has helped in consolidating PIM in the project.

The canal system is handed over to WUA with minimum or no rehabilitation. One should not wait for the system to get completely rehabilitate. As crucial part of PIM is their active participation in irrigation management, WUA will not function properly till responsibility is taken. Therefore, even though rehabilitation of canal system is essential, the transfer of management should not be prolonged till the system gets completely rehabilitate. On the contrary adequate repairs can be undertaken after the transfer, as active participation of WUA is more important rather than physical rehabilitation.

VOLUMETRIC MEASUREMENT OF WATER

In Katepurna project, there were Standing Wave Flume (SWF) for measurement of water at head of canal and at off-taking branch/distributory canal. Proper account of water was also maintained in prescribed format. At minor head, there was no arrangement for measurement of water. Thus CutThroat Flumes (CTF) are fixed at head of WUA and calibrations of existing SWFs are carried out.

A two-day training programme was carried out with the help of WALMI to train field officer as well as WUA functionaries for volumetric measurement and its accounting. Initially, there was apprehension among common farmers that CTF is obstructing the discharge passing down the system. There were instances of tampering of CTF also, but timely dialogue and enlightening them with functioning of CTF. has removed doubt from their mind.

As the system was handed over to WUA without complete rehabilitation of canal system, WUAs are charged on basis of lower of either volumetric supply of water or area measured. This provision has removed apprehension that they would have to pay more as the system is not in order. At the end of season, it was found that charging on basis of volumetric measurement of water is lower than the area basis. Table No.2 shows, sample example of comparative charging on volumetric and area basis. It can be seen that there is saving in water charges when charged on volumetric basis. Though saving is small, it will increase as the farmers get acquainted with volumetric measurement and use of water saving practices. It resulted into general acceptance among farmers to go for volumetric measurement of water. There is also provision in the act to use water saved in Rabi season, in hot weather season. This provision has encouraged the farmers to go for volumetric measurement and to make efficient use of water. Volumetric measurement of water is key to sustainable irrigation management. In Maharashtra, due to last 10-15 years work in this area, farmers are well acquainted with volumetric measurement and less resistance to volumetric measurement among majority of farmers, which could not found in many parts of country and abroad.

IMPACT OF MEASURES IMPLEMENTED

With persistent effort for participation of farmers in irrigation management, there was record irrigation of 5940 ha in year 2000-2001, which is almost 100% of revised irrigation potential. Also there was complete utilisation of water in reservoir. It can be seen from Table-3 that it was for the first time in the history of Katepurna irrigation project.

It can be seen from Table-1 that WUAs are formed over entire command area of the project. It is really interesting to know that where farmers were reluctant to go for irrigation and were blaming irrigation authority for the state of affairs, are now not only coming forward to form WUAs but are also shouldering the responsibility irrigation management.

PROJECT LEVEL COMMITTEE

With formation of WUAs on complete command area, for better co-ordination among various WUAs and with the department, project level committee of WUAs was formed. The project committee consists of representatives from WUAs. The executive body of committee has 11 members headed by a chairman. There was unanimous nomination of members as well as Chairman to the committee. The committee was involved right from the preparation of preliminary irrigation programme. The project level committee has helped in developing good co-ordination among various WUAs and the Department.

DE-RESERVATION OF WATER FOR NON-IRRIGATION

The movement of WUAs has resulted in getting irrigation to those who were deprived of water. Some farmers have received water after 10-15 years or even for the first time. The farmers, who had lost the hope, were now assured that they would get water. This has resulted in rapid increase in demand of water for irrigation.

Due to less utilisation in the past, there was curtailment in water reserved for irrigation from 49.45 Mm^3 to 27.83 Mm^3. It resulted in reducing irrigation potential from 8325 ha. to 5967 ha. Thus farmers were going to be deprived of their right of irrigation. On the contrary, the project was constructed mainly for irrigation and distribution system was already developed. The farmers had lost their land in canal construction and now they were going to be deprived of water. The sense of deprivation was not strong earlier as they were not getting water. But once they found that, the adjacent farmers are getting benefits, the farmers started agitating for their right. There was growing demand from farmers to cancel the additional reservation for non-irrigation and restore their original command. WUAs and their project level committee agitated for review of reservation for non-irrigation use and demanded release of water for irrigation.

It is observed that maximum use for non-irrigation is 24.00 Mm^3 as against 46.82 Mm^3. It means that the non-irrigation consumers have reserved water exorbitantly higher than their requirement. To find out an amicable solution among all irrigation and non-irrigation consumers, a review of allocation was taken under Chairmanship of District Collector. The consensus was reached among from all sector users, giving rational thought to present and future trends of utilisation. It was agreed to reserve 31.37 Mm^3 of water for non-irrigation and release 15.45 Mm^3 of water for irrigation use. The additional 15.45 Mm^3 of water will be provided for the area ,which was earlier proposed for curtailment.

The present review of water use has helped in reallocating water for irrigation, thus providing irrigation facility to those deprived. It is important to note that it was agreed amicably among all users without making any further complication.

The Katepurna project can be cited as a typical example, wherein, because of under-utilisation of water for irrigation, water was reserved for non-irrigation. But, with PIM, there was rapid increase in the irrigation utilisation. It resulted in growing demand for irrigation, which ultimately resulted in better utilisation of available water resources.

KATEPURNA SILVER JUBILEE FUNCTION

A novel function was organised by beneficiaries of Katepurna project on the eve of silver jubilee of the project. The beneficiaries felicitated the project-affected people for their sacrifice and engineers for their contributions. The project beneficiaries also felicitated the Government, for constructing the project, which had changed their lives. Indebtedness ceremony on the eve of Katepurna Silver Jubilee function was organised by beneficiaries to express their sense of gratitude and attachment towards the project. It was a unique gathering of society, the Government and media. Hon. Chief Minister of Maharashtra State chaired the function and commended for organising a novel function. The Chief Minister also called for organising such programmes at other projects to honour contribution of the projects in national development and to reiterate sense of part of the project. This function was appreciated from all corners of the State.

"SINCHAN SAHAYOG"- A NON-GOVERNMENT ORGANISATION

'Sinchan Sahayog' is a NGO established at Akola to promote PIM and improve irrigation performance. Sinchan Sahayog is established with inspiration and guidance from Dr. Madhavrao Chitale, Ex-Secretary General, ICID. Sinchan Sahayog working committee has representatives from Agriculture University, Irrigation Department, agricultural industrialist, seed experts, economists, socialists, members of legislative assembly, media personnel and farmers. Broad objectives of the organisation are to promote strategies of the efficient and effective use of available water resources, to undertake training programme, to encourage people's participation in irrigation management. The Akola centre has contributed in educating, training and providing solutions to farmers. Sinchan Sahyog has taken active participation in promoting farmers to form WUA and to adopt improved irrigation practices. Sinchan Sahayog, Akola had launched water literacy campaign for farmers by demonstrating, educating them water measurement and accounting of water

DISTRICT FEDERATION OF WATER USERS ASSOCIATION (WUAS)

To strengthen the participatory movement in the district, federation of WUAs is formed at district level. The federation will co-ordinate among the WUAs' and with Irrigation Department. It will address issues of WUAs at various platforms to find solution over difficulties in forming WUAs, its working and the development. The federation is registered under the Co-operative Act. To have better co-ordination with irrigation department, federation office is located in irrigation office premises. Establishment of federation of WUAs of district level is the first such attempt in the State.

INSTITUTIONS IN IRRIGATION MANAGEMENT

The federation of WUAs, Sinchan Sahayog and the Irrigation Department is working hand in hand to promote PIM and improve performance of the irrigation project. It has led to positive relationship among farmers, experts from various fields and the department. This experiment has shown very encouraging results. With this integrated approach and mechanism, farmers are coming forward for adoption of latest technology, improving water use efficiency, going in for crop diversification as well as processing and marketing of farm produce.

A FILM ON SUCCESS STORY OF KATEPURNA PROJECT

A film was shot on "Success Story of Katepurna project" highlighting how the participatory approach has helped in better utilisation of water resource of the project and extending benefits to more number of farmers. The film has been found useful in persuading the people to adopt participatory approach in irrigation management.

KATEPURNA TOURISM CENTRE

Katepurna eco-toursim centre was started at project site with a view to provide tourism facility as well as to educate people about water resources of basin and contribution of the project. The centre has helped in creating public awareness about water resources management. Education while Entertainment (Edu-tainment) is found to be very effective in mass education.

SHARING OF KATEPURNA SUB-BASIN WATER RESOURCES

While designing the project, stress was given to provide irrigation and water supply facility to villages in saline belt area which are at the downstream end and covers more than 1/3 of Akola district. Katepurna project has a main dam near village Mahan and Pick up weir at Khambora, which is 17 km away from the dam. The water is released from the dam as and when required to feed the weir, from where the canal off takes. Thus the 45% command lies in saline belt and that too in Purna basin of which Katepurna is sub basin. The domestic water supply is provided initially to Akola, district headquarter and 53 villages in saline belt, but under-utilisation of water for irrigation has resulted additional reservation for water supply to Murtijapur town which is far away from project and also to the number of villages along the Katepurna river. Akola city and Murtijapur town both fall in Purna sub basin.

With the benefits accrued to farmers of Katepurna command, the farmers in Katepurna sub-basins started demanding that they are real stakeholders of water of the sub-basin and they are deprived of water. Barring Katepurna project, there are a few minor irrigation tanks/weirs catering needs of two or three villages. Only farmers along the Katepurna river, upto pick up weir are able to get assured water, but they have to spend heavily on lifting the water.

In year 2002-2003, there was heavy flood in Katepurna river, damaging fields along the river. This has triggered more impatience among farmers in sub-basin, arguing one side they are not getting water of Katepurna and on the other side, they have to face flood damages in a cycle of 8 to 10 years. No doubt, the concerns of farmers in Katepurna sub-basin were genuine. Farmers so demanded construction of new canal from dam foot to cater the irrigation needs of farmers in Katepurna sub-basin. Also it can be seen from the yield in Katepurna project during last 25 years, that there is more availability at project site than its utilisation resulting in spill over from the project. It is not yet tapped in the sub-basin and ultimately it flows to Purna River then to Tapi basin. It resulted in agitation from farmers of the sub-basin to provide irrigation facility. They had also declared that they would not allow the release of water to Akola City as urban people use more water than they are supposed to. On the other hand farmers of Katepurna command (which is mostly in Purna basin) were acknowledging the demand of farmers of Katepurna sub-basin, but were not ready to part with the benefits.

It was observed that Katepurna project receives more yields than that can be utilised. Thus there is overflow from dam and as there is no structure to store the water downstream, the water goes to Purna basin. There is a proposal of construction of lower Katepurna project downstream of the existing Katepurna project. There is another alternative to use the water resources by storing excess water from Katepurna in minor tanks/KT weir through network of existing canal.

The total yield available from Katepurna sub-basin is around 240 Mm^3. So far water resources utilised through completed irrigation project is 125 Mm^3. The additional 9.32 Mm^3 water will be utilised after completion of on-going irrigation project. It is also planned to harness 90.57 Mm^3 of water resources through construction of medium and minor irrigation projects. Thus, there is planning of utilisation of 224.46 Mm^3 of water resources, which is nearly equal to available yield from the sub-basin. The abstract of completed, on-going and proposed irrigation projects in the sub-basin are given in Table-4. The ground water availability in the basin is varying while groundwater in saline belt is not suitable for water supply as well as irrigation.

DIALOGUE AMONG USERS

Thus to find out an amicable solution to all contradictory demands, Sinchan Sahyog has come forward to bring all the users on one platform to discuss rationally the existing as well as future water scenario. Considering the availability of surface as well as groundwater in the sub basin, discussions with the users and stakeholders are resorted to. The dialogue is taking place with initiative of Sinchan Sahayog and with participation of federation of WUAs', Irrigation Department, Water Supply Department and others.

As federation of WUAs has representatives from all over the district, the possibility of reducing the excessive consumption of water for irrigation, meeting out water requirement of Akola town from Morna sub-basin are also discussed. The issue of saving water by using water optimally, adoption of water efficient technology and adding the existing one by water conservation and rain water harvesting, recycling of waste water etc. are also discussed.

Last year there was 27% and this year, there is no live storage (dead storage of $3Mm^3$) in Katepurna project which has restricted its use to water supply only. Thus the need for proper sharing and efficient use of water has assumed more importance than ever. The discussions are going on with open mind and in fair manner. Rational thoughts will be given to present and future water use pattern and due consideration for saline belt in the basin. A plan for sub-basin will be prepared taking into consideration availability, requirement, restrictions and limitations.

The PIM in Katepurna project irrigation management has paved the way to participatory approach in management of water resources of Katepurna sub-basin.

CONCLUSION

Katepurna irrigation project is a representative scheme from Western Vidharbha where in there is under utilisation of irrigation potential. With PIM approach, it has resulted into not only complete utilisation of irrigation potential, but also farmers coming forward for allocating more water for irrigation purpose. The beauty of this case is that where farmers were reluctant to use water for irrigation, have how come forward strongly to demand more water by de-reserving exorbitant reservation for non-irrigation. Farmers and non-irrigation users have found out amicable solution with proper dialogue. The farmers have expressed their indebtedness to project by celebrating novel function of silver jubilee of the project.

With increased benefits to farmers in command area which is mostly in Purna sub-basin, farmers in Katepurna sub-basin and that too immediately downstream of dam agitating for irrigation facility saying that they are real stakeholder of water resources of Katepurna. Sinchan Sahyog a non-government organisation has come forward to bring all users and stakeholder on one platform to negotiate the process. The dialogue is in progress, a complete plan considering adoption of water efficient technology and adding the existing one by water conservation and rain water harvesting, recycling of waste water etc, will be prepared with users participation to share the water resources of the Katepurna sub-basin.

Table 1. Formation of WUAs in command area of Katepurna project.

Sr. No.	Year	No. of WUA formed	WUAs registered under Co-op. Act	Total area covered under WUAs (I.C.A. in ha.)	No. of beneficiaries	WUAs actual working
1	Up to 1998	4	3	1192	620	1
2	1999	2	1	0263	109	--
3	2000	4	3	1093	515	3
4	2001	10	7	2892	1247	4
5	2001	4	10	2425	921	10
5	2003	-	-	-	-	5
Total		24	24	7865	3412	23

Table 2. Comparison of assessment of water charges by volumetric method and crop area method in Rupees

Sr. No.	Name of minor	1999-00		2000-01		2001-02		2002-03	
		Volumetric	Crop area	Volumetric	Crop area	Volumetric	Crop area	Volumetric	Crop area
1	Borgaon minor no. 1	2102	3071	24471	27487	49477	53223	32890	55321
2	Borgaon minor no. 2	13490	13503	69171	74774	76187	93324	58919	98785
3	Dhatala minor					36936	39014	31672	42532

Table 3. Year wise irrigation and water used in Katepurna Project

Sr. No.	Year	Season wise irrigation in ha.				Season wise water used for irrigation in Mm^3				Non irrigation water use Mm^3	Max. storage in project Mm^3	Water balance of the end of year (30June) Mm^3
		Kharip	Rabi	Hot-weather	Total	Kharip	Rabi	Hot-weather	Total			
1.	**2.**	**3.**	**4**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**
1	75-76	2	1485	2	1489	0	9	1	10	1.813	86.35	49.96
2	76-77	111	1745	267	2123	2.25	13.95	8.01	24.21	4.53	86.35	56.81
3	77-78	9	1213	289	1511	0.50	9.70	7.17	17.37	10.05	86.35	58.76
4	78-79	5	656	93	754	0.30	5.25	2.79	8.34	11.64	86.35	35.09
5	79-80	0	532	10	542	0	4.26	0.03	4.29	12.56	86.35	68.86
6	80-81	0	1209	9	1218	0	9.67	0.03	9.70	12.44	86.35	63.09
7	81-82	0	1624	40	1664	0	15.99	0.17	16.16	12.7	86.35	16.08
8	82-83	13	1677	347	2037	1.19	15.09	22.28	38.56	13.19	86.35	14.77
9	83-84	0	954	387	1341	0	13.65	27.07	40.72	13.3	86.35	29.40
10	84-85	0	0	0	0	0	0	0	0	11.83	19.11	5.4
11	85-86	79	1515	355	2317	1-90	21.55	7.02	30.47	19.04	81.25	0.79
12	86-87	372	2936	1126	4434	4.76	38.05	25.03	67.84	16.82	79.50	13.22
13	87-88	175	3706	108	3989	5.00	30.00	1.00	36.00	23.73	62.34	11.94
14	88-89	0	1530	1313	2843	0	24.10	18.16	42.26	18.89	86.35	41.35
15	89-90	0	1150	764	1914	0	28.59	14.90	43.49	16.34	86.35	2.94
16	90-91	0	737	853	1765	0	11.43	17.99	29.42	13.8	86.35	14.5
17	91-92	2000	433	126	2559	10.77	1.39	4.00	16.16	17.42	41.50	16.05
18	92-93	0	999	1074	2073	0	22.08	22.41	44.49	14.98	86.35	6.27
19	93-94	0	1419	700	2119	0	20.66	20.85	41.51	14.345	78.78	28.88
20	94-95	0	2511	791	3309	0	30.27	14.54	44.81	15.71	86.35	17.22
21	95-96	70	1791	130	1991	0.50	12.71	2.47	15.68	17.51	34.34	1.09
22	96-97	0	1739	830	2569	0	14.83	16.50	31.33	16.88	84.89	22.99
23	97-98	142	1295	630	2067	0.47	9.18	13.05	22.70	17.055	59.27	22.63
24	98-99	0	1454	882	2336	0	10.17	21.53	31.70	18.88	81.99	43.90
25	99-00	0	2098	595	2693	0	15.33	13.29	28.82	19.087	86.35	31.12
26	00-01	1501	4081	358	5940	5.75	23.37	7.28	36.54	21.34	70.69	2.15
27	01-02	170	3258	470	3898	1.13	24.24	9.40	34.77	21.7	86.21	9.20
28	02-03	20	4335	493	4848	0.17	27.04	13.08	40.31	21.63	86.35	6.15

Table 4. Details of Non Irrigation Water Supply from Katepurna Project

(Figures in Mm^3)

Sr. No.	Year	Akola City Water Supply	53 Village Water Supply	Murtizapur City Water Supply	Akola Sugar Factory	M.I.D.C. Akola	FisheryMahan	M.I.D.C. Murtizapur	Borgaon Manju Water Supply	Total	Remarks
1	2	3	4	5	6	7	8	9	10	12	13
1	1975-76	0.003	0.45	0			1.36			1.813	
2	1976-77	0.25	0.82	0.2			3.26			4.53	
3	1977-78	5.59	0.84	0.36			3.26			10.05	
4	1978-79	7	0.89	0.49			3.26			11.64	
5	1979-80	7.94	0.86	0.47		0.03	3.26			12.56	
6	1980-81	7.94	0.58	0.58		0.08	3.26			12.44	
7	1981-82	7.94	0.79	0.59		0.12	3.26			12.7	
8	1982-83	7.94	0.91	0.69		0.39	3.26			13.19	
9	1983-84	7.94	1.06	0.72		0.32	3.26			13.3	
10	1985-85	7.94	1.03	0.78		0.44	1.64			11.83	
11	1985-86	12.16	2.51	0.57		0.5	3.3			19.04	
12	1986-87	8.76	1.4	2.81		0.54	3.31			16.82	
13	1987-88	8.72	1.46	9.78		0.45	3.32			23.73	
14	1988-89	8.22	2.2	4.84		0.32	3.31			18.89	
15	1989-90	7.8	2.2	2.78		0.42	3.14			16.34	
16	1990-91	7.49	2.11	1.07		0.27	2.86			13.8	
17	1991-92	7.62	3.45	2.66	0.05	0.32	3.32			17.42	
18	1992-93	8.41	2.13	1.1	0.01	0.37	2.96			14.98	
19	1993-94	8.08	2.22	1.09	0.005	0.48	2.47			14.345	
20	1994-95	8.94	2.23	1.08	0.16	0.52	2.78			15.71	
21	1995-96	10.13	2.53	1.43	0.04	0.55	2.83			17.51	
22	1996-97	10.28	2.63	1.08	0.03	0.58	2.28			16.88	
23	1997-98	10.08	2.53	1.03	0.015	0.66	2.74			17.055	
24	1998-99	11.96	2.43	0.94	0.2	0.59	2.76			18.88	
25	1999-2000	12.88	2.73	0.99	0.007	0.5	1.98			19.087	
26	2000-2001	13.18	2.58	2.96	0.56	0.62	1.44			21.34	
27	2001-02	13.23	2.53	3.31	0.22	0.61	1.80			21.7	
28	2002-03	14.9	2.4	1.68	0.14	0.6	1.91			21.63	
Water Reservation		24.03	0.79	2.83	1.0	14.95	0	2.05	1.17	46.82	
Revised reservation of water		24.03	0.79	2.83	0.50	2.00	-	-	1.17	31.32	

Table 5. Abstract of completed, on-going and future irrigation projects in Katepurna sub-basin

(Figures in Mm^3)

Sr. No.	District	Completed Project	Under Construction	Under Planning	Total Planned utilisation of water resources of sub basin.
1	2	3	4	5	6
1	Akola	113.01	0.629	88.274	201.91
2	Washim	11.559	8.692	2.297	22.55
	Total	**124.569**	**9.321**	**90.571**	**224.46**

IMPACT OF PARTICIPATORY APPROACH ON MANAGEMENT OF COMMUNAL IRRIGATION SYSTEMS IN UPLAND AREAS

Orlando F. Balderama[1] and Luzviminda L. Domingo[2]

ABSTRACT

This Study was conducted in 2004 at the service area of the Caraballo and Southern Cordillera Development (CASCADE) programme in three provinces in Northern Philippines. It was designed to assess the impact of participatory approach for development and management system employed for communal irrigation system (CIS).

Results show that economic impact was due to increase in productivity and cropping intensity. Across all crops, average productivity per hectare was highest in vegetable producing CIS.

The social impact of the project was determined at three levels: household, community and irrigators association (IA). At the household level, the benefits were more on increases in land productivity and cropping intensity as a result of the assured water availability even during summer, hence food and income of the household.

At the organization level, the following benefits were revealed namely; 1). Change in leadership structure paved the way for recognition of new leaders; 2) Improved leadership skills; 3). Increased participation of members in IA related activities; 4) Improved organization skills; 5) Enhanced cohesiveness among members and 6) Better partnership and mutual existence between the village Local Government Unit (LGU) and the IAs.

The integration of farming activities directly benefited the community. The LGU – IA partnership encouraged maximum utilization of the project as evidenced by increased cropping intensity and crop diversification.

The sustainability of the CIS-IAs are ensured through; (a) the internalized rules in the proper usage and maintenance of the systems ;(b) security of their livelihood against drought and (c) improved leadership capabilities and high level of control in the IAs.

1- Professor of Agricultural Engineering, Isabela State University, Echague, Isabela 3309 Philippines, Tel./Fax: 63-78-672-0078; email: orly_isu@yahoo.com
2- Community Development Specialist and Professor Isabela State University

I. INTRODUCTION

The environment is undeniably playing a critical role, especially in the economy of a developing country, like the Philippines. Economic activity has been the main source of pressure on the country's resource base. This is further compounded by the pressure due to the demand of the increasing population and the need to sustain food security.

In the Philippines, the uplands are among the most vulnerable ecosystem. This can be attributed, in part to the increasing migration of people to these areas in search for livelihood. This in turn has a trade off - environmental degradation that will eventually threaten the very existence of man.

To mitigate this problem, the Caraballo and Southern Cordillera Agricultural Development (CASCADE) Project was launched in 1997. This project through the partnership of the European Union – Philippine government, is an integrated area development program aimed at promoting the agro-based local economy and sustainable development of the indigenous upland and highland communities in 19 municipalities of Benguet, Nueva Vizcaya and Nueva Ecija of northern Philippines (see **Figure 1**).

One of the components of the project is the establishment of irrigation facilities to enhance food security and at the same time protect the environment from further degradation. As of October 2003, there were 39 communal irrigation systems (CIS) completed. Alongside with the development of the irrigation system, financial assistance was also provided to support the social infrastructure of the project areas.

The CIS was implemented through the participatory approach. The beneficiaries were actively involved in the management and development of the CIS in their locality. Thus, the impact of this approach for small-scale irrigation project was determined, hence this study.

II. OBJECTIVE OF THE STUDY

The ultimate goal of the study is for CASCADE and partners to be informed on economic and social impact of the project under the framework of participatory irrigation management approach and document information and experiences for the improvement and sustainability of the CIS projects.

II. METHODOLOGY

The methodology used in this project builds from earlier works done on participatory development for the past years. The methodology was based on the team approach on the assessment of the integration of participatory processes in community based projects. It intensively makes use of a combination of focus group discussion, triangulation supported by actual field visitation with the beneficiaries, interviews and actual physical assessment of fields served by the project. The data gathering and discussion however did not consider thoroughly issues with bearing on cultural sensitivity. Likewise, due to lack of logistics, not much data was collected to draw conclusions on the effect of the CIS in the environment.

The steps undertaken in the conduct of the study were as follows:

1. REVIEW OF CASCADE'S STRATEGIES FOR IRRIGATION DEVELOPMENT

A thorough review of CASCADE's strategies, thrusts and programs on irrigation development was done from available documents provided by the project. This preparatory work enabled the research team to describe, characterize, and do initial profiling and categorization of existing CIS assisted by CASCADE.

2. ACTUAL FIELD VISITATION, SURVEY AND FOCUS GROUP DISCUSSION

- Physical Data and Service Area of 16 representative CIS operating for at least six months were measured using the most appropriate equipment/method available.
- Socio-Economic, Management and Operations - Data on the management and operations of the Irrigator Association (IAs), social and economic impact of the project was gathered from sampled CIS units. It was done through interview with key informants and beneficiaries. The primary data were gathered with the use of questionnaire, and focus group discussion.

3. DETERMINATION OF SAMPLING SIZE

Out of the 39 CIS completed and operational for at least one cropping, sixteen (16) CIS sample sites or 41% of the total CIS were selected for impact analysis. The criteria for selection were as follows: geographical location, type of system intervention, cropping system, type of irrigation, project cost, number of beneficiaries and declared service area.

4. ASSESSMENT AND ANALYSIS OF DATA

The indicator used in measuring economic impact of the various CIS in the CASCADE area was the increase in production per hectare as evidenced by: expansion in area served, increase in productivity (i.e. increase in production per hectare; and increase in cropping intensity.

The assessment for social impact was done in three levels; household (beneficiary level), Irrigator's Association and the community.

At the management level, the written reports on the participatory strategies employed in the implementation of the project were verified as to how these were implemented by the management and at the beneficiary level. At the beneficiary level, both focus group discussion and interview were used in the collection of data.

The levels of participation of the members of the IAs were rated using the following: 3-high, 2-medium and 1-low. Participation were measured in terms of level of the type of involvement namely; 1- if participation was for attendance to meetings only; 2- for attendance to meetings and participation to planning and decision making and; 3- for undertaking all of the items including contributing in labor, efforts and funds in the operation and maintenance of the IA and the CIS.

The context of sustainability is measured for the extent of participation, status of the physical structures (relative to vulnerability of the environment of the structure); records on activities undertaken (meetings, consultation, trainings); organizational control; commitment of leadership; availability of trained leaders and commitment of the leadership of both IA and LGU. These were scored by the evaluating team based from results of survey and field visits and later validated with the community. Each organization is scored based on the total value. These were correlated with other variables that will explain the sustainability of each IA.

Organizational control is scored by the beneficiaries based on the following items: 1) group cohesion; 2) attendance to meetings; 3) LGU complementation; 4) effectiveness of leader to enforce rules and discipline and influence members. This criterion was validated using problem identification with the beneficiaries through focus group discussion.

III. RESULTS OF THE STUDY

A. PROJECT PROFILE

The irrigation systems in the CASCADE area are small, low-cost and located in vulnerable areas with slope greater than 20%. Water sources were either creek or Small River and spring water. The CASCADE's development assistance to CIS comes in three forms: a) capability building; b) communal irrigation systems physical structure (new construction, rehabilitation and improvement) and; c) other support services like microfinance and enterprise development. **Table 1** shows the type of infrastructure for the CIS's and the impact on water supply. Also, **Figure 2** shows an example of CIS for rice and vegetable production in the study area.

Table 1. Water acquisition facilities and their impact on water supply

Name of CIS	Infrastructure	Crop	Impact on water supply
Manamtam	River Intake	Rice	water supply is always enough – no impact
Dilan	Reservoir	Vegetable	new irrigation service area
Libawan	1 diversion weir	Rice+Vegetable	increased+more stable supply
Botilao	1 diversion weir	Rice+Vegetable	increased+more stable supply
Proper Pudi	1 diversion weir	Rice	increased+more stable supply
Lower Sisi	1 diversion weir	Rice	increased+more stable supply
Capintalan	1 diversion weir	Rice	increased+more stable supply
Yaway	River Intake	Rice + Vegetable	Stable water supply
Ammococan	1 diversion weir	Rice	increased+more stable supply
Decabacan	1 diversion weir	Rice	increased+more stable supply
Batu	River Intake	Rice-Rice-Onion	water supply is always enough – no impact
Dutac	River Intake	Rice + Vegetable	Stable water supply
Abogan	Spring Intake	Rice + Vegetable	Stable water supply
Balete-Bagtang	2 units Reservoir	Vegetable	new irrigation service area
Batawil-Sabdang	2 units Reservoir	Vegetable	increased+more stable supply
Dapong	3 small diversion weir	Vegetable	increased+more stable supply

The purpose of communal irrigation project is to increase production through increasing water supply, and protect the environment that supports the project with the community as the main actors of the development process. The project studied covers a total of 267 hectares planted into rice, a combination of rice and vegetables and vegetables only.

<u>The Respondents</u>

There were 128 respondents in the study, but only seven of which are women (see **Table 1**). Vast majority of the respondents were members of tribal communities called Ibalois and Kalanguyas - the indigenous people in the northern uplands of the country.

Table 2. Respondents Profile

Number of Respondents	128
Type of Respondents	
IA Officials	69
IA & LGU Officials	21
Members	38
Age bracket	45 – 74
Educational Attainment	At least elementary education
Average Household Size	5.4 heads
Average land area, multiple cropped areas	.48 ha.
Average land area, single cropped (rice)	.96 ha.

System Performance

On the whole, the systems studied had an increased cropping intensity of 21%, a distribution efficiency of 40% (much higher than National Irrigation Admininistration's 10-15%), and a fair satisfaction rating given by the members interviewed.

In terms of the respective roles of the IA's in planning irrigation-related activities, it was observed that in general, there was no uniform practice across the system studied.

There was a poor collection of Irrigation Service Fee (ISF) except from the three project sites. All projects that were visited are believed to be functioning efficiently with minimal conveyance losses because of the use of pipes in the case of vegetable irrigation and lining of canals for rice irrigation.

B. OVER-ALL BENEFITS DERIVED FROM THE PROJECT

1. Economic Impact

Results show that most of the impact was due to increases in productivity and increases in cropping intensity. Only one CIS had an increase in area served. Across all crops, average productivity per hectare was highest in vegetable producing CIS. The average aggregate annual benefit per farm was P116, 274 (2,300 USD)

Considering the total construction cost as the initial investment of the various CIS and the increases in the value of benefits due to increases in productivity, cropping intensity, and area as the project benefits, the payback period computed ranged from 0.05 year to 1.99 years. This payback period for investment projects is quite fast. This result implies that the investment cost in these CIS can be recouped very quickly. Also, this implies that the direct benefits from CIS are high.

2. Social Impact

The project created impact at three levels; community, organization (IA) and households' level. The positive impact at the community level included increased access to resources like the construction of water bridges out of collected service fees and external sources for microfinancing,

At the organizations' level, the IA's generally learned to cope up with maintenance problems especially when their livelihood security was threatened with inadequate irrigation water. These enhanced the cooperation among farmers and ness in others, leadership development, market integration among vegetable growers, and more cohesive relationship of the IAs and the LGUs.

C. STRATEGIES OF PARTICIPATORY DEVELOPMENT AMONG CIS

Participatory development in the communities was legally established through Republic Act 7160 signed in 1992. The law provides decentralized decision making at the lowest local government unit – the barangay or village level. Projects were established based on needs of the community. Through the representation of their officials, the community decides on what type of projects will be established. Each barangay is granted Internal Revenue Allocation (IRA) from the national government based on their population, land area and revenue collections. The IRA is however utilized primarily for infrastructure projects like roads, bridges and buildings. With the assistance of the CASCADE project, the covered communities were able to access other resources for development while making use of indigenous knowledge.

In the implementation of the Communal Irrigation Projects, the participatory development strategies employed are as follows;

1. Involvement of the local government officials from the provincial to the community in the planning, and operation of the projects. This strategy gave the local government a first hand look on the economic and environmental conditions in the project sites;
2. Facilitating the integration of various government services and programs into the community;
3. Formulation of "Rules-in-Use" by the members of the IAs;
4. "Counterparting Scheme" for various stakeholders (i.e. IAs contributing labor in the construction and operation and maintenance of the irrigation projects);
5. Trainings on capability building not only on maintenance and operation of the projects, but also negotiations, decision-making, resource generation and communications strategies.

D. EVIDENCES OF PARTICIPATION

1. <u>Contribution to the Construction of the CIS.</u>

Participation is in itself shown primarily in the construction of the facilities. On the average, the beneficiaries contributed more than 22 % of the total project cost in the form of labor and food.

2. <u>Indicative Increase in Organizational Control</u>

The level of organizational control increased in most of the CIS. Maintenance and operation has become easier to implement in IAs with high to medium level of organizational control. **Table 3** shows the ratings on level of performance on organizational control and the main reasons for the performance ratings.

3. Development of New Leaders

In some IA's, new sets of leaders were regularly elected to manage the projects. This is one of the off-shoots of participatory approach.

Table 3. Levels of organizational control exercised by the various CIS

Name of CIS	Level of Organizational Control	Reasons for the Performance
Dapong	High	• Vigilant leadership • Proper resource sharing • Involvement of women
Manamtam	High	• Effective leadership • Group cohesion
Decabacan	High	• Committed leaders • Visible projects
Batu	High	• Good leaders • Presence of NGO's
Capintalan	Medium	• Infrequent meetings • Little service fee collection
Yaway	Medium	• High dependence to project
Dutac	Medium	• Weak organizational structure
Abogan	Medium	• Few committed leaders
Balete Bagtang	Medium	• Infrequent meetings • Little service fee collection
Batawil Sabtang	Medium	• Organizational problems
Dilan	Medium	• Infrequent meetings • Little service fee collection
Libawan	Medium	• Low level of organiza • tional discipline
Botilao	Low	• Crisis-driven cooperation • Farms are not ideal
Proper Pudi	Low	• No collection of service fees • Highly silted areas
Lower Sisi	Low	• Ineffective leadership • No elections or meetings
Ammococan	Low	• Low level of interest to the project

4. Relationship of Participation to the Sustainability of the CIS.

Table 4 presents a result matrix of Pearson R correlation technique to show relationship between participatory measures to various indicators of sustainability of the CIS. It can be noted that the CIS and the IA has a good chance to continue sustainably even after the project ends as it indicated a significant relationship. The main reason is because the project would ensure the availability of water for irrigation to the farms hence the security of food for the family; and supported by higher income due to increased in productivity. The CIS project increased cropping intensity by more than 20% to as high as 100% after the establishment of the project.

The matrix revealed that as long as irrigation water secures the food and livelihood of the members, the farmers will continue to support the project. Given this nature of Livelihood-CIS relationship, the importance of the CIS will subsequently enforce agreed relationships and will shape the behavior of the farmers-members towards the power nexus of the IA.

Table 4. Correlation Matrix of Participation to Other Variables

Variables		Increase in Productivity	Sustainability	Participation	Household Size
Increase in Productivity	Pearson Correlation	1	0.496	0.624 (**)	0.716 (**)
	Sig. (2-tailed)	.	0.051	0.010	0.002
	N	*16*	*16*	*16*	*16*
Sustainability	Pearson Correlation	0.496	1	0.709 (**)	0.397
	Sig. (2-tailed)	0.051	.	0.002	0.128
	N	16	16	16	16
Participation	Pearson Correlation	0.624 (**)	0.709 (**)	1	0.576 (*)
	Sig. (2-tailed)	0.010	0.002	.	0.020
	N	*16*	*16*	*16*	*16*
Household Size	Pearson Correlation	0.716 (**)	0.397	0.576 (*)	1
	Sig. (2-tailed)	0.002	0.128	0.020	.
	N	*16*	*16*	*16*	*16*

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

SUMMARY AND CONCLUSION

1. ECONOMIC AND SOCIAL IMPACT

Important results of the study show that most of the economic impact was due to increases in productivity and cropping intensity. Only one CIS had an increase in area served. Across all crops, average productivity per hectare was highest in vegetable producing CIS. Considering the total construction cost as the initial investment of the various CIS and the increases in the value of benefits due to increases in productivity, cropping intensity, and area as the project benefits, the payback period computed ranged from 0.05 year to 1.99 years. This payback period for investment projects is quite fast. This result implies that the investment cost in these CIS can be recouped very quickly. Also, this implies that the direct benefits from CIS are high.

The project has also created social impact at three levels; community, organization (IA) and household's level. The positive impact at the community level included increased access to resources like the construction of water bridges out of collected service fees and external sources for micro-financing,

At the organizations' level, the IAs generally learned to cope up with maintenance problems especially when their livelihood security is being threatened due to inadequate irrigation water. These factors will enhanced the cooperation and cohesiveness among farmers, promotes leadership development and mutual existence of the IAs and the LGUs.

2. CHARACTERISTICS OF A SUSTAINABLE AND STABLE IRRIGATORS ASSOCIATIONS.

Several characteristics of the Irrigators Association were found to be good measure for their long term sustainability as follows:

1. The members are involved in the planning, operation and maintenance of the irrigation systems.
2. Support Services were broadened and integrated into the project operations.
3. Rules formulated were tied up with water distribution criteria.
4. The members and young leaders are mentored on how to make rational decisions

3. PROSPECTS FOR REGIONAL EXCHANGE OF INFORMATION ON PARTICIPATORY MEASURES

The study has generated a wealth of information on the impact of participatory measures in irrigation management in the community-based projects of upland and mountain environments. A full documentation of the experiences are very good case studies for dissemination in regional forum and publication outfits. Other countries working on the similar environment and context can benefit on the strategies of participatory process employed in this undertaking.

Likewise, a collaborative research and development work and continuing exchange of information on the regional and international scale is worth pursuing.

REFERENCES

1. Balderama O. and B. Ausa. 2002. Terminal Report on Evaluation of Communal Irrigation Projects at the Sierra Madre Natural Park. Plan International, Isabela State University, Cabagan, Isabela, Philippines.

2. Balderama, O. 1998. Development of Crop and Water Management Model for Reservoir Irrigation in the Philippines. Unpublished Doctoral Thesis. Department of Agricultural Engineering. The University of Tokyo, Tokyo, Japan.

3. CASCADE Annual Report 1998 and 2000. Bayombong Nueva Vizcaya, Philippines

4. CASCADE Highlights Publication. Jan.-March 2000. Vol. 3 Issue No.1. Bayombong Nueva Vizcaya, Philippines

5. Cruz, R.D. 2002. Municipal Irrigation Master Plan for Diadi, Nueva Vizcaya. Volume 2 - Project Monitoring Tools. CASCADE, Bayombong Nueva Vizcaya, Philippines.

6. ERP-CASCADE/Economic self-Reliance Programme-Caraballo and Southern Cordillera Agricultural Development Programme-Philippines. January 1998. Global Work Plan for 1997-2004. Bayombong Nueva Vizcaya, Philippines

7. Ridder,D.,E. Mostert and H. Wolters (ed.) .2005. Learning Together to Manage Together-Improving Participation in Water Management. University of Osnabruck, Germany.

Figure 1. Project Location

Figure 2. A view of a Communal Irrigation System for rice and vegetable farms

ROLE OF WATER USERS COOPERATIVES IN OPERATION AND MAINTENANCE OF SOUFI CHAI IRRIGATION AND DRAINAGE NETWORK

Ali Maleki Milani[1], Yousef Toutakhaneh[2], Gholamreza Fani[3]

ABSTRACT

Management of Irrigation and Drainage Networks (IDN) by government in the past few decades has not resulted in optimal operation and maintenance and the irrigation efficiencies are far below the design bases. Failing to collect the water fees has been another incentive for the East Azerbaijan Regional Water Authority (EARWA) to think of the beneficiaries as the main custodians of the network both in design and implementation stages of Soufi Chai IDN and this was in accordance with the traditional network operation management in the region. Therefore, for the first time in the country, 17 Water Users Cooperatives (WUC) were formed in 1994 within the framework of Note-26/ Budget Act of the same year and cooperatives were allowed to participate in the implementation of the network. the consulting engineers considered the opinions and rights of the beneficiaries in design. The implementation of the Alavian Storage ended in 1999. For a short while, EARWA operated the system, then holding a tender, the operation and maintenance management was conferred on a contractor. As a part of the network management, WUC annually makes contracts with the contractor for the delivery of volume- based irrigation water to be distributed among users. WUC participates in operation and maintenance management of Grade-1&2 Canals, collects the water fees from the members, has remarkable part in settling the disputes and sociopolitical issues. EARWA is trying to build the union of water user's cooperatives to confer on them the operation and maintenance management of the whole IDN downstream Alavian Storage Dam.

Key words: EARWA, IDN, WUC

1- Ali MALEKI MILANI, Utilization and Subscribers Affairs Deputy, East Azerbaijan Regional Water Authority, Boulevard 29-Bahman, Tabriz-IRAN E-mail: maleki21@yahoo.com
2- Yousef TOUTAKHANEH BONAB, Maragheh Water Affairs, Maragheh-IRAN
3- Gholamreza FANI, Office of Subscribers Affairs and Surface Water Utilization, East Azerbaijan Regional Water Authority, Boulevard 29-Bahman, Tabriz-IRAN E-mail: gholamreza_fani@yahoo.com

1- INTRODUCTION

Studying the measures taken in the route of large hydraulic structures realization in 1950's and 1960's for the purpose of water supplying and distribution, we witnessed the rapid development of agriculture in developing countries including Iran. This strategy brought about several problems on rural communities. One of the main sources of these problems has been neglecting presence of rural people in management and planning of IDN's. Experts believe the way to tackle with the prevailing issues is to return the people to management arenas. Because disregarding the rural people had no result but improper operation and maintenance of IDN's & lowering the irrigation efficiency, etc. This, which was the case with many of the government managed IDN's, originated from focusing on hardware aspects (structures) and neglecting the software including the residents. Persons in charge had no exact idea then about the operation and maintenance costs and out-comes of putting aside the farmers in the management arena. Finally, in the late 1960's it was clarified for the governments that, the water fees would not suffice to supply costs of IDN's implementation, operation and maintenance and other expenses. Then, for three decades the solutions and methodologies were in the global focus and understood that, only part of this deficiency results from financial restrictions and the major part roots from failing to understand the necessity of presence of rural community in planning and the major role of farmers in network management. In our country too, the subject of popular partnership in implementing the modern IDN's has come to notice since a decade ago. Regarding the available experience from the irrigation networks in use (e.g. Moghan), EARWA intended for the first time in the country to tackle the executive and optimal operation and management of an IDN (Soufi Chai) through supporting and forming Water Users Cooperative.

2-LOCATION AND LIMITS OF SOUFI CHAI IDN

Soufi Chai IDN lies on the south slope of the mount Sahand and southeast of Urmia lake, 140 Km away from Tabriz towards southwest. This area is divisible into four distinct zones from viewpoints of crop pattern and the existing or newly constructed structures.

Zone-1: Including the orchards and farms upstream of the diversion dam to Alavian Storage Dam and vicinity of the city of Maragheh in the total area of 2500 hectares. IDN was not implemented in this Zone due to topographic conditions, high slope, well developed orchards on terraced lands owned by private sector. This Zone is irrigated by seven traditional canals branched from the Soufi Chai River the intake of which have been amended or newly constructed and receive water in term of volume.

Zone-2: 440 hectares in area, this Zone is located downstream Maragheh Diversion Dam between the 18 Km Right Main Canal and Soufi Chai River and is irrigated via four Secondary Canals.

Zone-3: Lying among Maragheh Diversion Dam, Left Main Canal and Soufi Chai River, this Zone is 2408 hectares in area and is irrigated by five Secondary Canals. Built on a river with the same name, Khanghah Diversion Dam is meant to utilize the surface water for this Zone in irrigation season.

Zone-4: This Zone includes Bonab Plain and the lands after Zarrineh Roud water conveyance pipeline and is irrigated by 14 Canals branching from Soufi Chai. A water need of this Zone is met from Alavian Dam, runoffs and the extra water in Khanghah Chai from September to June and from ground water resources in June to September. This Zone is 2850 hectare in area and its development is under study on Bonab area.

3- GENERAL SPECIFICATIONS OF SOUFI CHAI IRRIGATION AND DRAINAGE NETWORK

Table 1: General Specifications of Soufi Chai Irrigation and Drainage Network

Network Area	12’000 ha	Length of Secondary Canals	33.2 Km
No. of Irrigation Zones	4	Length of Secondary Drainage	5 Km
No. of Diversion Dams	2	No. of Main Irrigation Canals	2
Length of Main Irrigation Canals	30.8	No. of Secondary Canals	9
Length of Main Drain	33.6		

4- CLIMATE

Mean precipitation in the project area is 331 mm per year out of which 250% falls in autumn, 30% in Winter, 40 % in Spring, and 5% in Summer.

According to Amberge climatologic classification, the project area lies in semi-arid cold zone. The hottest and coldest months of the year are August and February.

5- PURPOSES OF THE SCHEME

- Supplying irrigation water for Maragheh and Bonab regions
- Flood control
- Income increase and job creation

6- HISTORY OF WATER RESOURCES UTILIZATION BEFORE IDN IMPLEMENTATION

An annual discharge record of Soufi Chai shows no similar volume and time distribution on the course of several years. Due to such an unforeseeable behavior, it has been called Soufi Chai, which means “Sufi River” in Azeri language. There are lots of historical remnants on the banks, which indicate ancient civilizations in the area. Climatologically, this area is semi-arid and surveys prove that climate and changes in river regime have had a crucial role in formation of guilds and utilization of water, so that users have come together to cooperate and have eventually attained the proper methods of allocating each user’s water-right.

According to the studies carried out, discharge of Soufi Chai used to be more the needs in winter and spring and all villages except Yengi Kand Khousheh Mehr could take irrigation water from the river as per their water-right, with the beginning of summer river discharge would decrease and water was allocated in accordance with the water-right. Local trustees of the traditional canals around Maragheh, Khousheh Mehr and Narj Abad would hold a coordination meeting in the first week of summer and elaborate a timetable for the water distribution of villages and canals according to their water right. The first seven days of each month was allocated to irrigation of Narj Abad and Khousheh Mehr (3 and 4 days, respectively), and half of the river discharge was allocated to Pahr Abad and Padegan and in rest of the days the orchards around Maragheh would be irrigated. Canals Trustees were in charge of policy making and supervision over water distribution and special maneuvers were carried out in drought periods such as avoiding irrigating the harvested trees or diverting all available water into one canal for a short period.

In villages of Rusht Bozorg, Sarj, Aghajeri, Akbar Abad, Zavesht, Rusht Kouchak, and Dizaj Navlou that have no summer water right, people would cultivate cereals and irrigate them via the canal passing through the city. Representatives of the said villages would hold coordination meeting in early October to elaborate the cereal cultivation of villages and their irrigation timetable till late June. The villages Chalghaei, Dizaj Parvaneh and Ghaleh Khaleseh take their irrigation water from Soufi Chai via separate canals.

In Bonab and the villages downstream, where Soufi Chai flows till early June, orchards and farms are irrigated by river water and in summer months by underground water. There are no summer water rights in the project area except for the seven traditional canals and Narj Abad and Khousheh Mehr villages, therefore, water is distributed by agreements based on common practice with no consideration to the water requirement of the crops.

7- NECESSITY AND MODE OF EMPLOYING WATER USERS' SERVICES IN WATER RESOURCES MANAGEMENT

After carrying out the studies up to detailed design and at the beginning of IDN implementation phase, experience of mangers of EARWA in connection to non-participation of people in operation and maintenance of hydraulic structures and inefficiency of governmental management in this area, motivated the attraction of popular participation in all stages of IDN implementation and operation and the following came to their agenda to be sought on the whole EARWA:

1. Attraction of popular participation in water distribution management for optimal use of water and adjustment of social issues
2. Motivating the sense of possession among water users towards the IDN in favor of extending its useful life
3. Diversifying the financial sources of water projects and providing part of the sums needed and increasing investment in such projects
4. Reducing the government's domain of affairs

Implementation of Soufi Chai IDN was the first IDN construction experience after Islamic Revolution by the EARWA in East Azerbaijan province, and attraction of the strong traditional water users guilds present in the area, was an on important event in the engagement of beneficiaries in implementation of IDN's.

Thus, EARWA was required to urge the responsible bodies and gain cooperation of other governmental offices. To attain this, meetings were held with the said people explaining the goals so that, elaborated was the memorandum of Water Users Cooperative using memorandum framework of other cooperative companies and the same were approved. For the first time ever in Iran, 17 WUC's were registered and established in Zones-2& 3 of the IDN. These cooperative companies took measures in respect of concluding Civil Partnership contracts with Bank Keshavarzi (Bank of Agriculture) under Note-3/ Budget Act 2003 and Note-26/ Budget Act 2004 and the facilities granted were at the disposal of EARWA and spent for IDN implementation. In 1999, with Soufi Chai IDN utilization commencement, to institutionalize water distribution sector, to realize goals of Irrigation Water Use Optimization by-Laws, the existing traditional guilds were promoted to WUC's. In Zones 1&4, WUC's were registered and established as well. Following table shows status of the WUC's in Soufi Chai IDN.

Table 2: Names and Details of WUC's in Soufi Chai IDN

Zone	Name of WUC	Name of Guild	Being Established	Establishment Year	Village	Township	Irrigated Area/ha
1	-	Alavian	-	-	Alavian	Maragheh	90
	-	Nava	-	-	Nava	Maragheh	120
	-	-	Talebkhan	-	Talebkhan	Maragheh	150
	Haj Kord	-	-	-	Haj Kord	Maragheh	200
	Pahr Abad	-	-	2002	-	Maragheh	272
	-	Jooi Shahr Maragheh	-	-	-	Maragheh	180
	Ghiamat Abad	-	-	2002	-	Maragheh	400
	Amir Jamal	-	-	2002	-	Maragheh	250
	-	-	Pesteh Ju	-	-	Maragheh	300
	Varjuri	-	-	1996	-	Maragheh	800
	-	Darvazeh	-	-	-	Maragheh	50
2	Rusht Bozorg	-	-	1995	Rusht Bozorg	Bonab	1382
	Ghaleh Khaleseh	-	-	1995	Ghaleh Khaleseh	Bonab	253
	Sarj	-	-	1995	Sarj	Bonab	577
	Dizaj Parvaneh	-	-	72	Dizaj Parvaneh	Bonab	357
	The three Chalghaei's	-	-	1995	Tazeh Kand Qeshlaq Chalghaei	Bonab	634
	Dizaj Navlou	-	-	1995		Bonab	154

Zone	Name of WUC	Name of Guild	Being Established	Establishment Year	Village	Township	Irrigated Area/ha
2	Zavesht	-	-	1995	Zavesht	Bonab	388
	Rusht Kouchak	-	-	1995	Rusht Kouchak	Bonab	450
	Aghajeri	-	-	1995	-	Bonab	301
	Akbar Abad	-	-	2002	-	Bonab	205
3	Khousheh Mehr	-	-	1993	Khousheh Mehr	Bonab	800
	Yengi Kand Khousheh Mehr	-	-	1993	Yengi Kand Khousheh Mehr	Bonab	600
	Tazeh Kand Zavaregh	-	-	1993	Tazeh Kand Zavaregh	Bonab	150
	Narj Abad	-	-	1993	Narj Abad	Maragheh	380
	Zeinagh	-	-	1993	Zeinagh	Maragheh	89
	Khanghah	-	-	1993	Khanghah	Maragheh	80
4	Kor Arkh Gazavesht	-	-	1993	Kor Arkh Gazavesht	Bonab	465
	Mehrabad	-	-	2002	Mehrabad	Bonab	587
	Qarachopoq	-	-	2002	Qarachopoq	Bonab	895
	Zavaregh	-	-	2002	Zavaregh	Bonab	765
	Khanehbarq Qadim	-	-	-	Khanehbarq Qadim	Bonab	300
	Khanehbarq Jaded	-	-	-	Khanehbarq Jaded	-	435
	Yengi Kand Khanehbarq	-	-	-	Yengi Kand Khanehbarq	-	170
	Qeshlaq Khanehbarq	-	-	-	Qeshlaq Khanehbarq	-	300
	Ali Khajeh	-	-	-	-	-	-
	-	Kuteh Mehr	-	-	-	-	-
	-	Supergan	-	-	-	-	18
	-	Sari Gullar	-	-	-	-	35
	-	Qarashir	-	-	-	-	30

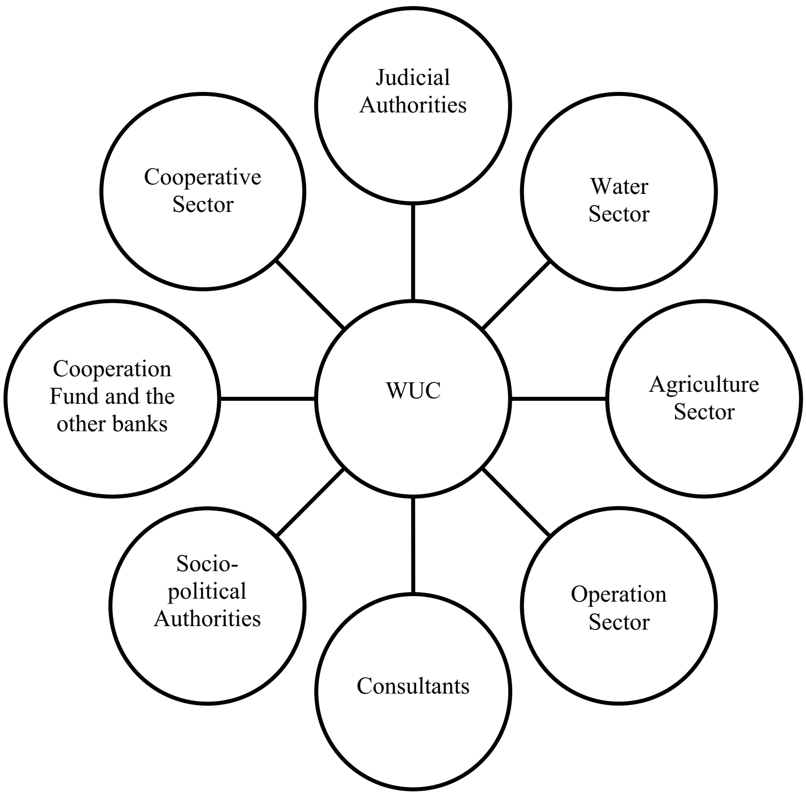
8-STRUCTURE AND FUNDAMENTS OF WUC

Gaining the permission from Water Affairs and letter of agreement from the cooperative sector, WUCs are formed after holding General Assembly meeting and elections of Directors Board. Cooperative Department sends results of elections and the decisions made to Deeds and Real Estates Registration Department and after the company is registered at Companies Registration Department and its Establishment Notice is publicized on the Official Gazette of the Islamic Republic of Iran, the Company commences its legal activity. WUCs have three organs:

1. General Assembly, to approve the proposals;
2. Members of Directors Board to operate;
3. Inspector to supervise the operations and report to General Assembly.

Supervision on activities of WUCs is done by Cooperative Department as a policy-maker. WUCs are active on the basis of their memorandum in the areas of water distribution maintenance, protection of the IDN, improvement of canals, implementation of tertiary canals and submit their opinions to Consulting Engineers for in improving the water distribution efficiency. For realizing the goals and activities of WUC's they keep in touch with the authorities mentioned below:

Figure 1: Diagram showing the relationship between WUC and pertinent offices



A review of WUCs history shows that at the beginning, they were only active in the area of water distribution among their members but as time passed, WUCs developed their activities and promoted their role in operation management and maintenance of IDN so that having established WUC Union to seek larger share in IDN management. EARWA intends to confer such management on WUC Union in the coming years by supporting them.

9- ROLE OF WUC IN MANAGEMENT, OPERATION AND MAINTENANCE OF SOUFI CHAI IDN

WUC's have played effective part in the following areas as a segment of IDN management factors:

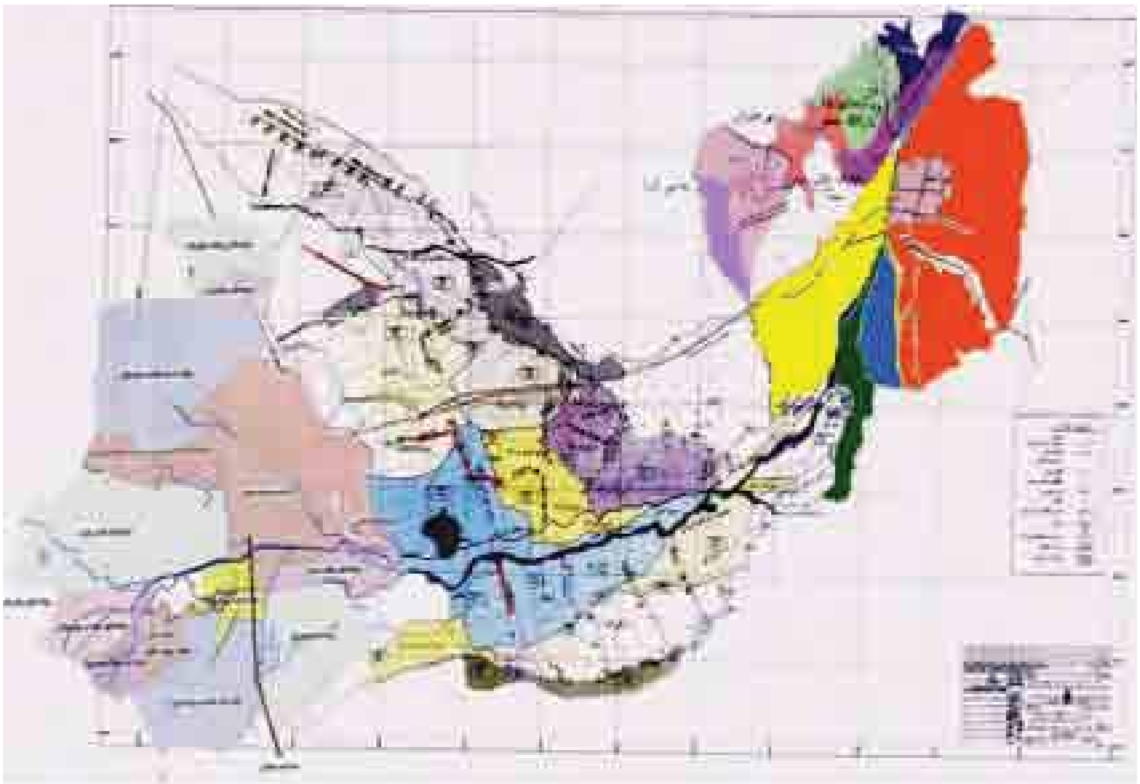
1. Orientation of the members and expediting the implementation process;
2. Conclusion of irrigation contracts for water distribution among water users;
3. Protection of the irrigation network and secondary canals;
4. Adjustment of legal and social issues;
5. Participation in administrative meetings and extending the agricultural policies.

The Following is a detailed explanation of the above.

9-1- ORIENTATION OF THE MEMBERS AND EXPEDITING THE IMPLEMENTATION PROCESS

Having a financial contribution to the project, WUCs played an important part in expediting the implementation operations. This contribution urged the persons in charge to finish the job in time so that water users could pay installments of their loans utilizing the IDN. WUCs announced their ideas in the course of IDN implementation and such opinions have been of great effect in easing the IDN operation. Also, parts of the IDN, which were not executed for the reasons like financial restriction for land acquisition, WUC convinced their members to let the EARWA to perform the secondary canals. Figure 2 shows route of canals implemented with the pursuance of WUC's.

Figure 2: Soufi Chai irrigation and drainage network plan



At present, equipping and renovation is underway by Agricultural Jihad that is in charge of coordination among members, all social issues and presentation of correctional opinions to the consulting engineers and WUCs have a strong executive role at the service of Agricultural Jihad in improvement of canals.

9-2- CONCLUSION OF IRRIGATION CONTRACTS FOR WATER DISTRIBUTION AMONG WATER USERS

Annually, WUCs receive area list of lands to be cultivated by the members and conclude a formatted contract of irrigation and draw up a monthly timetable with the IDN Utilization Company. Based on this timetable, each cooperative attempts to irrigate their lands in accordance with their local common and practice and deliver the members' water fee bills also collecting the sums or the payment receipt to deliver to EARWA. Rendering services to their members, WUCs reduce number of referring to governmental office and by cooperation in preparation of water distribution timetable, increase satisfaction level of people and their optimal water use. Water users announce the adequate time of irrigation and this way increase the water use efficiency. The map shows activity area of each cooperative.

9-3- PROTECTION OF TERTIARY CANALS OF THE IDN

Water delivery point of each WUC is according to the map. Delivering the secondary canals to the WUCs, they get a more important role in servicing and maintenance of the IDN and show a serious conduct towards people who may harm or disuse the canals.

WUCs consider protection of canals a privilege for themselves. Traditional tertiary canals too, are managed and protected by cooperatives.

9-4- ADJUSTMENT OF LEGAL AND SOCIAL ISSUES

Managing Directors of WUC's who are responsible bodies before the members, amicably solve lower legal problems like violating irrigation program and try to prevent the case to be referred to legal authorities as far as possible and play an effective role in social matters through orientation of the members.

9-5- PARTICIAPTION IN ADMINISTRATIVE MEETINGS AND EXTENDING THE AGRICULTURAL POLICIES

By their presence in the meetings of irrigation water use optimization, WUC Managing Directors set forth the opinions and problems of their members

And by applying the regional agricultural policies, they play an important part in agricultural extension issues.

10- CHANLLENEGE FACING WUCs

In the present conditions, legal protections and executive ambiguities are the main challenges of sustainable development of the WUCs. Role of WUCs in water resources management is not defined for the legal authorities and they are not legally supported. For the same reasons, they are devoid of financial protection too.

11-SUGGESTIONS:

Although WUCs have proved their positive role and efficiency in water distribution and service rendering, agricultural development is influenced by many factors Therefore, it is suggested to form a united institution for focusing the protective activities of executive organizations in a single unit. Such an institution will execute all agricultural policies and can have an effective role in agricultural development.

12-REFERENCES:

1. Seyed Ahmad HEIDARIAN, 2005, How's and Why's of Transferring Irrigation Management, 4th Technical Workshop on Cooperation of Farmers and IDN Management
2. Reports of Mahab Ghods Consulting Engineers on Soufi Chai IDN.

INTEGRATED APPROACH ON SUSTAINABILITY OF IRRIGATION SCHEME

Gatot Irianto[1]; Samsul Huda[1]; Istiqlal Amien[2] and Hilman Manan[1]

ABSTRACT

Irrigation network is vitally important for distributing water to fulfill crop water requirement at precise timing, quantity and quality to ensure good agricultural production both in terms of quantity and quality. Due to the economical crisis from 1997 up to know, most of irrigation networks in Indonesia have been deteriorated, and are not yet performed well till present. This problem causing the system of irrigation networks are unable to fully provide water demand sufficiently.

For resolving this problem, an integrated approach and effort are demanded to save the existing water, rehabilitate irrigation networks and sustaining irrigation management for future generation. Irrigation development in Indonesia has been started since The First Long-term Development Plan, during the period of 1970-1990, technical irrigation areas have increased more than 2.6 million hectares from 1.5 million to 4.1 million hectares. Under this achievement, rice production was reached to a magnitude of 15 million ton/year, and by the year of 1984 Indonesia has attained self sufficiency in rice production. Unfortunately, this self-sufficient condition can not be maintained for a long time, and instead Indonesia has been transformed into rice importer. The decreasing of water quantity, quality and continuities are amongst the important constraints of the transformation into rice importer.

Accordingly, a strategy needs to be formulated in order that the function of the existing irrigation schemes could support providing irrigation water in accordance with the economic time horizon with proper management to ensure its sustainability. For this, the basic concept of integrated approach under the era of regional autonomy will be discussed in this paper. This concept is divided into three major aspects, namely: management, integrated, and revolving fund system approach. Due to the past planning and development policy of irrigation, which emphasized the "top-down" approach, the entire management on irrigation networks became the government domain, with very limited involvement of the farmers as the end users. Incidentally, however, due to continuous financial crisis, the government could no longer fully provide the operation

1- Directorate General of Land and Water Management
Gatot_irianto@deptan.go.id; gatot_irianto@yahoo.com
2- Agency for Agricultural Research and Development of Ministry of Agriculture Indonesia; Jalan Taman Margasatwa No. 3 Jakarta Selatan – Indonesia.

and maintenance costs. On the other hand, the management transfer of irrigation to the farmers, are not acceptable, having understood that the government should take the full responsibility for developing and managing irrigation. Based on this experience, participatory approach among the stakeholders on planning, development and management should be strengthening.

Key Words: Integrated Approach, Sustainable Irrigation Management

BACKGROUND

The function of irrigation network is vitally important in distributing the water for obtaining crop water requirement at precise timing, quantity and quality to ensure good agricultural production. Presently, various problems are widespread concerning water resources. Among others are decreasing of irrigation water supply on the one hand, and increasing water demand on the other. The decreasing water supply is currently due to the effect of decreasing dependable water resources due to the escalating degradation of the catchments-area of the rivers. Meanwhile, the increasing water demand is due to the increasing population and escalating economics growth. Water use efficiency is generally low among others because of the poor condition of irrigation networks, the water user association (WUA's) are not performing and functioning as expected, and the application of efficient water management technology has yet extensively adopted. In addition, the water quality is also decreasing due to the underlying contamination from industrial disposal, household wastes, agriculture, and sea-water intrusion.

The above problem has therefore causing water scarcity both spatially and temporally, where the system cannot cater the water demands. Eventually, the water scarcity brought about unfair competition in water use among sectors or sub-sectors. Without concerted efforts in solving the problems above, it will be very difficult to be able to save or conserve the existing water resource for future generation.

PRESENT CONDITION OF IRRIGATION IN INDONESIA

Irrigation development in Indonesia have been started since the First Long Term Development Planning **(PJP I)** of the country. During the first two decades (1970-1990) technical irrigation areas have increased by more than 2.6 million hectares from 1.5 million to 4.1 million hectares. The irrigated land has boosted paddy production by about 15 million ton/year, almost one-third of the national requirement **(Afif, 1992).** By the year of 1984 Indonesia has attained self sufficiency in rice.

However, due to the impacts of insufficient maintenance together with natural disasters, the irrigation infrastructure experienced of extensive deteriorations. Floods have damaged the irrigation networks at about 100,000 hectare per year. In the year of 2002 the flood damaged had come up to about 172,000 hectares. In 2004 the earthquake and tsunami in Nanggroe of Aceh Darussalam and Nias Island, destroyed more than 21,000 ha of irrigated agriculture. Most recently, the quake and volcanic eruption in Yogyakarta and Central Java, as well as the tsunami event in Pangandaran, West Java (July 2006) also damaging significantly on irrigation infrastructures as well as agricultural lands in the said areas.

From the data of 2002 the irrigation networks developed in Indonesia have a total capacity to serve 6.77 million hectares of rice fields. Of which, about 48.3% of irrigation networks are in Java, 27.1% in Sumatra, 11.7% in Sulawesi, and 6.8% in Kalimantan, while the remaining, 6.1% in Bali, Nusa Tenggara, Maluku, Papua, and West Irian Jaya Provinces. Of the total of irrigation developed above, it is estimated that around 1.67 million hectare, or almost 25% has yet functioning well as expected. These poor-functioning irrigation networks due to a number of problems and constraints, including the yet completed network system, inadequate water sources, some of the paddy fields has yet to be fully developed, or even due to the non existence of the farmers and farmer's organization in some areas. Similarly, this matter is also happened in the lowland irrigation networks – of the 1.80 million hectare that had been developed, only about 0.8 million hectares (44%) are currently functioning. Complementary to these, the non functioning irrigation networks also suffered from damages due to the low quality of operation and maintenance. At present, the total estimated area that experience damages on their irrigation networks had almost come up to about 30%, and most of damages occurred in the national rice producing areas on Java and Sumatra Islands.

The problems are exacerbated by the degradation of the catchment areas. The degraded lands in the upstream areas are almost come up to the magnitude of about 40 million hectares. On the other hand, the problems are also worsened by to the increasing population, which entailed with rapid rate of agricultural lands conversion into non agricultural utilization. In 1984 degraded catchment areas was 22 locations, but by 1994 the magnitude became 39 locations of degraded catchment-areas. Most recent statistics indicated that in 1998 the degraded catchment areas had reached 62 locations. This degradation has significantly brought about negative impacts on the continuity of dependable water flows.

Beside the poor condition of irrigation infrastructures, the water use efficiency is also very low. In many cases, the precious water is wasted unnecessarily when it abundant in the main, secondary and farm levels without proper distribution management. Meanwhile, the quality of irrigation water for the agricultural sector is also degraded by the contamination of industrial disposal, domestic and urban wastes, as well as the sea water intrusion.

Climate anomaly add to the problems with uneven distribution of the intra-seasonal, seasonal and annual water distribution. Drought triggered by El-Nino phenomenon in 1997, for example have caused damages of paddy crops in more than 500,000 ha and 88,000 ha of the areas suffered from crop failures. Other than El-Nino the cooling of eastern part of Indian Ocean as also known as positive dipole mode (IODM) in 2003 have caused more than 500,000 ha damage paddy crop and more than 117,000 ha of crop failures.

Agricultural lands conversion to non agricultural uses such as industrial, housing, and infrastructure in last ten years has increased to 100 % from 40,000 ha per year to 80,000 ha per year. All the above conditions have been happened and have negatively influenced the performance of irrigation systems. Therefore, a strategic actions need to be formulated in order that irrigation schemes could be well performed, and hence provide irrigation services in accordance with expected the economic age and sustainable management of the entire irrigation schemes.

CONCEPT OF INTEGRATED MANAGEMENT APPROACH

A. MANAGEMENT APPROACH

The concept of integrated approach in irrigation scheme has to be carried out from early stage of the development up to the operation and maintenance stages – i.e. from development planning, technical design, construction execution, operation and maintenance and eventually monitoring and evaluation as well as follow up actions for subsequent improvement. In the past, the development policy on irrigation infrastructures were emphasized on the top-down approach, that had created many problems, including technical as well as non technical , particularly during the operation and management stages. For resolving the underlying predicaments, this orientation should be shifted to ***bottom-up approach***. In general, the concept of integrated approach on irrigation water management must be carried out, among others by:

- Involving the relevant parties and stakeholders concerned both in terms of ***vertical*** as well as ***horizontal*** organizational structures.
- Utilizing all the locally existed practices in the society (local broad-based empowerment) with special attention on ***indigenous technology*** and ***knowledge*** as well as ***practical experiences***.
- Appropriate technical guidance and other requirements of local community concerning ***natural endowment that evolved into cultural experiences***.

In the new Water Law *(Undang-undang No. 7)* year 2004 regarding water resources that was enacted after prolonged debates irrigation water at farm level shall be managed and handled fully by the farmer through water user association. Consequently irrigation development shall involve farmers since the planning process. This requires a participatory irrigation management system. The concept of participatory irrigation system is now growingly adopted worldwide.

The benefit of participatory irrigation management approach is the growing ***sense of belonging and responsibility*** from all participants, ensuring that the development results would be similar to the expected requirement, including the improvement of the ability of the farmers to utilize the development outputs, clearly defined working process in the field, and strengthening the ability of farmers to manage further irrigation networks.

In principle, participatory irrigation system is positioning the farmers as the main water user and become the focal point on decision making processes. Together with other stakeholders, all the irrigation development activities are conducted within the entire development and management process, from planning, implementation, until its operation, and the entire decision making are discussed and decided to together.

In relation with the participatory approach, there are several preconditions that must be fulfilled, those are: demand driven, participatory, transparency, flexibilities, decentralization, openness, accountabilities, and integrity both in the social and technical aspects. ***Demand driven*** is means that all activities proposed and conducted by the members so in such a way that they comprehend their duty and responsibility. Hence, involvement of all farmers through their organization in management of irrigation network is imperative by means of ***participatory*** approach. Meanwhile, ***transparency*** means that all the funds have to be expended properly and informed all the participants openly. ***Flexibility*** means that any specified rules can be executed when necessary, without a rigid bureaucratic process. Decision making process also involving all the member without dependency on one particular person or organization (***decentralization***). ***Openness*** means that every report can be accessed by all farmer members. ***Accountable*** means that any income obtained and expenditure spent have to be technically and administratively audited. ***Integrity of socio-technique*** means that irrigation is not simply technical problem but also social cultural problems, therefore, the sound understanding on local tradition and customs must be considered in planning and managing of irrigation infrastructural development.

B. INTEGRATED APPROACH

The concept and approach of integrated approach in irrigation area management is involving entire stakeholders actively from early stage (planning, construction) to operation and maintenance, as well as monitoring and evaluation stages. According to the **U.U. SDA 7 - 2004** (Water Law) that farmers or WUA have responsibility in the management of on-farm irrigation network. But when the farmers or WUA are not yet able to manage the network for effective operation and maintenance, the government will assist them.

Conception of integrated approach is focused on the participation of all stakeholders in management of network (operation and maintenance). Therefore the government side (Central, Provincial and District Government Administration) and farmers are partners in the management of irrigation networks. For illustration, based on experiences that had been conducted in many years on the sharing of the expenses, **Table 1** presents some examples of budget sharing in participatory irrigation management. The central government, province and district government together with the farmers/WUA sharing the Operation and Maintenance budgets for financing the activities such as repairing channels, making of water receptacle, appropriate water allocation, procurement of water pump and preparation of diversion boxes and other such on the farm level infrastructures and operational expenditures.

From the data that are presented in **Table 1**, it is highly plausible that the existence of adequately high willingness and awareness of the farmers to manage irrigation in improving farming production are amongst the determinant factors of the failure of success of participatory approach.

Table 1. Budget Sharing on Participatory Irrigation Management in some selected frovinces (East Java, Central Java, and Lampung Provinces).

(Rp. 000,-)

No	Location	Central	Province	District	Farmers	Output
1	Gebangan, Krejengan, Probolinggo, East Java	44,783 (39%)	25,000 (22%)	4,000 (3%)	41,010 (36%)	Rehabilitate of irrigation canal, gate and pumps
2	Kemuning, Kramat, Tegal, Central Java	43,683 (22.6%)	108,000 (55%)	1,260 (0.7%)	42,390 (21.7%)	Pipe irrigation Diversion box, pumps.
3	Sukanegara, Bangun Rejo, Central Lampung, Lampung	43,102.5 (36.85%)	21,550 (18.43%)	9,850 (8.42%)	42,444 (36.30%)	Diversion box and rehabilitation of irrigation canal

C. REVOLVING FUND SYSTEM APPROACH

Present issues regarding irrigation in Indonesia are related to the lack of participation and contribution of farmers and water users in the operation, maintenance and management. Until present, the government still takes dominant role in irrigation management and development. Irrigation system is still treated as public infrastructures or utilities that must be managed by the government. Farmers and water users are positioned only as beneficiaries. As the result, farmers and water user associations tends to be inresponsive and ignorant to the system condition.

Along with the financial problem and economic crisis, the capacity of the Government of Indonesia to cover the costs for operation and maintenance of irrigation system has declined sharply. As a result, more than 60% of the irrigation system has decreased and still decreasing in their performances.

Through experiences, it had been identified that the key factor of the sustainability of irrigation systems is laid highly dependent upon the presence of sustainable financial source (and support) for operation and maintenance. Continuously relying on the government budget is obviously far from possible, while instantaneous budget from donor, that the farmer used to rely in the past, is also unsustainable. For which, strategy for financing irrigation operation, maintenance and investment in terms of ***Revolving Fund System for Irrigation*** is presently recommended.

The concept of revolving fund system for irrigation implies that for the WUA the water fee shall be divided in two parts, one part is for operation and maintenance, and another part shall be kept as repayment of the improvement cost. Experience indicates that the ideal composition of water use fee is 60% for operation maintenance and 40% is for cost recovery. The Management of Revolving Fund System for Irrigation Investment is presented in **Chart 1,** below.

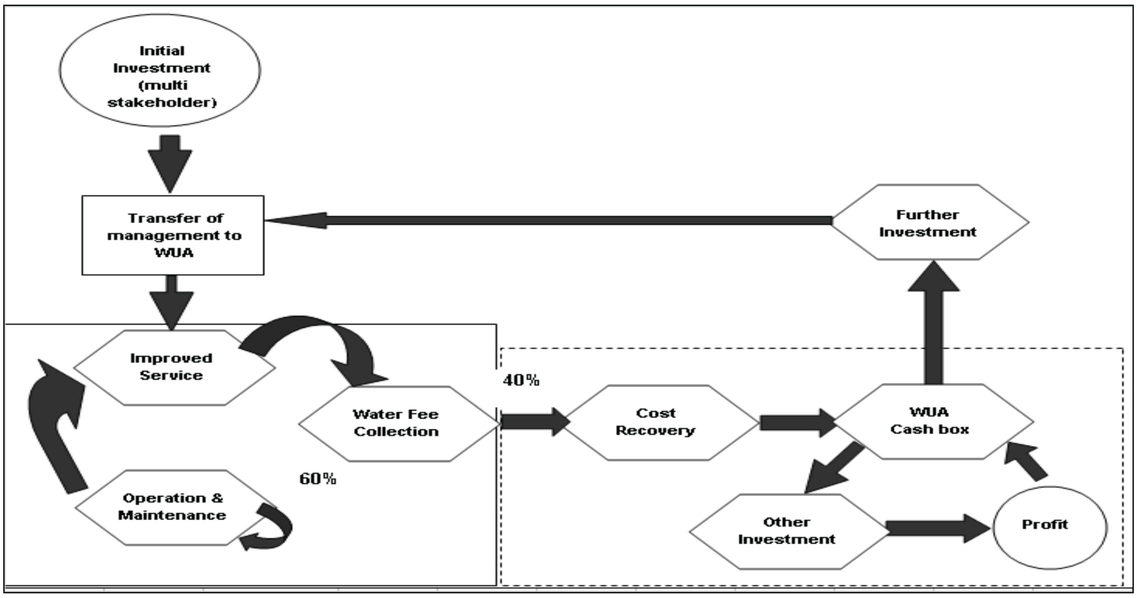


Chart 1. Management of revolving fund system for irrigation O&M investment

CONCEPT OF SUSTAINABILITY OF IRRIGATION SCHEME

The concept of sustainability in irrigation scheme is not a quilt of some aspects as technical, social, cultural and economic aspects. A sustainable irrigation scheme can be attained when:

- Management of irrigation scheme including operation and maintenance (O&M) should be shifted from supporting ***monoculture only (paddy)*** to become providing water to ***various crop types (diversified crops)***.
- Management of irrigation has to develop flexible irrigation (reliability, flexibility, equity), that can provide irrigation water to various crop types, this requires the ***change in existing irrigation system device and pattern of O&M.***
- Irrigation is basically has the character and function fundamentally as supporter of agricultural or farming activities. Therefore, irrigation must be fitted with agricultural and farming activities. In other words ***irrigation scheme is develop to support agriculture not the other way around***.
- Policy in the development and management of water resources should be ***balanced between downstream and upstream areas***. Presently, too much attention are given to downstream areas, and consequently the upstream areas became degraded.
- Improvement of community participation from all stakeholders in irrigation management from planning, construction execution, O&M, as well as monitoring and evaluation.
- Increasing the efficiency of irrigation water management through ***appropriate technological innovation*** to the small scale farming.

- Fair utilization, conservation and protection of water resource with consideration of social justice have to be implemented and become common goal. Utilization, conservation and protection of water resources by applying fair share is the common interest of the society without any discrimination on the right to get or access to water resources.
- Policy management of water resources to support food security is not only for annual food crop sub-sector, but also for other ***sub-sector as horticulture, estate crop and livestock***.
- Integrating the irrigation development and management with the agricultural sector is fundamentally important. Negligence of the integration will result in expensive social and economic risks, as revealed by unutilized irrigation networks.
- ***Preventing the conversion of agriculture farms to another functions*** such as industrial, housing, and others. A step in the prevention is the preparation and enaction of legislation as well as regulatory instruments.
- A new policy formulation relating to water resources management in accordance with ***decentralization and regional autonomy*** has to be formulated and enacted judiciously. These policy formulation consist of proper distribution of delegation of authority, duty and responsibility among institutions at central, provincial and district levels.

BIBLIOGRAPHY

1. Republic of Indonesia, 2004. Pemerintah Republik Indonesia, 2004, ***Undang Undang SDA 7*** Tahun 2004 (Indonesian Water Law No. 7/2004).
2. Republic of Indonesia, 2004. ***Rencana Pembangunan Jangka Menengah Pengairan TA. 2004-2009***, Intermediate Long Term Planning for Irrigation Development; Irrigation and Water Resources Bureau, Bappenas, 2004.
3. Anonymous, 2005. ***Kebijakan Operasi dan Pemeliharaan Prasarana Pengairan Mendukung Ketahanan Pangan***, Directorate of Water Management, Directorate General of Land and Water Management, Ministry of Agriculture, 2005
4. Anonymous, 2003. ***Pedoman Pelaksanaan SPFS Indonesia***, Food Security Board, Ministry of Agriculture 2003.
5. Anonymous, 2004. ***Model Pengelolaan Irigasi Partisipatif***, Directorate of Water Management, Directorate General of Agricultural Facilities, Ministry of Agriculture, 2004.
6. Robert Chambers, 1992. ***Managing Irrigation Canal***, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi, 1992.

ABOUT THE AUTHORS

Hilman Manan born 2 July 1951 in Bandung. He got master from IHE-Delf, Nederland. Specialist in hydraulic and expertise on water resources development and management. He is now director general of land and water management, Ministry of Agriculture.

Istiqlal Amien is senior scientist and knowledge engineer at the Indonesian Agro-climatology and Hydrology Research Institute, Bogor. Holds master degree in soil chemistry from State University of Ghent, Belgium and Ph.D in soil management from University of Hawaii, USA. Soil scientist by training, Agro-meteorologist by profession and environmentalist he has experienced in developing expert systems.

Gatot Irianto born, 24 October 1961 in Halmahera Tengah. He obtained Ph.D. in Hydrological modeling, Ecole National Superieure Agronomique Rennes, France. He is now director of water management, Ministry of Agriculture. Hydrology scientist, lecturer, author on many newspaper, proceeding, etc.

Samsul Huda born 2 May 1968 in Nganjuk. Hold master in irrigation water management from Indian Institute of Technology Roorkee, India. Engineer, Specialist in irrigation water management and evaluation performance of irrigation system.

IRRIGATION MANAGEMENT TRANSFER: WORLDWIDE EFFORTS AND RESULTS

Giovanni Munoz[1], Carlos Garces-Restrepo[1], Douglas L. Vermillion[2], Daniel Renault[1] and Madar Samad[2]

INTRODUCTION

This paper summarises information collected from a range of countries worldwide. A database with all the information collected as well as other related documents led to the creation of a specialized webpage on the subject managed by FAO, found at: http://www.fao.org/landandwater/aglw/waterinstitutions/. The paper is structured into five sections. This first section provides a brief introduction to set the stage of why irrigation sector reform has emerged. In section 2, the policy and legal framework for IMT are presented. With respect to policy, the section addresses the requirements to support IMT programmes as well as to establish Water Users Associations, the cornerstone of the transfer process. The elements present in the implementation of IMT programmes is the subject of section 3. In sequential order, the document addresses IMT strategies such as the scale of transfer, the scope of activities included and the speed of implementation. In section 4 the paper brings together the outcomes and impacts derived or expected from the reform. Section 5 summarizes key conclusions and recommendations.

1.1. BRIEF HISTORICAL BACKGROUND OF IMT AND DEFINITION OF CONCEPTS

Serving the external debt has been the main driver for Bretton Woods institutions to pursue general structural adjustment strategies all throughout the indebted world (Sen, 2000). Governments have therefore devised ways to decrease public spending in most sectors. This disengagement has not spared agriculture and the irrigation sector in particular. This is not surprising as the World Bank estimates that since the 1950's it has lent some 35 billion dollars for irrigation development or an equivalent seven percent of all its lending (Plusquellec, 1999).

For the development of public irrigation schemes, governments had set up irrigation agencies that not only identified, designed and built irrigation schemes, but were also engaged in their management afterwards. It was therefore common in many countries that the irrigation agency would receive one of the largest budgets dedicated to the

1- Food and Agriculture Organization of the UN, FAO: Munoz, Garces and Renault belong to the Land and Water Development Division. Contact details: E-mail: Giovanni.Munoz@fao.org;
Phone +39 3485589108; Fax: +39 0657056275. Via delleTerme di Caracalla, 00153 Rome.
2- International Water Management Institute, IWMI. (Vermillion is a former IWMI staff).

agricultural sector. In many countries the irrigation agency became a powerful enclave with large bureaucracies and considerable territorial presence. In several countries this has also implied strong political power and influence not only on local and regional levels but also on central governments. National Irrigation Agencies running irrigation schemes were often not successful in keeping pace with infrastructure deterioration as low fee collection rates and decreasing budget allocations from central governments allegedly hamper their maintenance capabilities. Likewise, operation activities often were not up to farmers' expectations and this decreased their motivation to promptly pay the dues to the scheme managers. This created a deterioration cycle that led to the idea of transferring the management of the scheme directly to the water users with the underlying principle that farmers would be able to operate and maintain the irrigation scheme properly and would be able to collect the water service fees from a satisfied group of peer users.

In dealing with IMT issues a second interrelated concept is often encountered, and referred to as Participatory Irrigation Management or PIM. Normally this refers to the increased involvement of water users in irrigation management, along with the government; and thus consists more of a behavioural or attitudinal change than a reform process per se. Thus, while the IMT concept intends to replace the role of the government, PIM seeks to strengthen the water user-government relationship, by adding farmer participation to government management. The concepts intersect at the "co-management" stage of IMT where before a final transfer takes place the government agency and the recipient organization agree to share responsibilities. Thus, the point is made herein that while having intersecting elements, the two concepts are not exactly the same and therefore are not interchangeable.

To further capture the meaning of IMT, it is convenient to define other concepts that are found in the realm of institutional reform and that often touch irrigation. **Decentralization** is the movement of decision-making authority to regional or local levels from a central authority, but still within the same organization. **Privatization** refers to the transfer of ownership of assets from the government to the private sector. In the case of irrigation, the assets would be represented by the systems themselves — irrigation and drainage network— and by equipment.

1.2. EXTENT OF IMT WORLDWIDE

Irrigation Management Transfer is a true worldwide event; it is taking place in countries in all five continents. While the IMT "boom" can be place in the 90s, this type of reform can be traced as far back as the 60s in Bangladesh and USA, the 70s in Mali, New Zealand and Colombia and the 80s like in the Philippines, Tunisia and Dominican Republic. The careful reader should not fail to note the diversity of the geographical and economic regions represented above. The new century already shows examples with interventions taking place in Sudan and Pakistan (2000), India (2001), China (2002) and more recently in some of the Central Asian countries, experiencing a process of different intensities. Today, more than 60 countries have embarked in some type of irrigation sector reform. These countries constitute around 75% of the world population and represent some 80% of the irrigated area of the world of 277 million ha (FAOSTAT, 2003). These countries include the 42 shown in Figure 1 plus: Guatemala, Laos, Vietnam, Ethiopia, Jordan, Madagascar, Mauritania, Cyprus, Georgia, Kazakhstan, Macedonia, Moldova, Ukraine and Poland. Since then, other countries where reforms are ongoing are Russia, Slovenia and the Chez Republic.

1.3. FAO AND IWMI'S BREADTH OF IMT-RELATED ACTIVITIES

This paper presents the synthesis of a programme on the subject of irrigation sector reform initiated by FAO and its partners in the year 2000. With the generous support of the Ford Foundation and in collaboration with the International Water Management Institute, a rather broad set of activities were designed. Other organizations, such as the World Bank and the International Network for Participatory Irrigation Management (INPIM), joined from time to time in making specific contributions. The main activities carried out included: an **International E-mail Conference** which was held in 2001 counting over 400 participants from 80 countries; preparation of thirteen **IMT in-depth case studies** in countries which have gone through a major process of IMT were prepared covering 11 countries; preparation of 43 **IMT Country Profiles** representing 33 countries and that can be seen as a brief description of the IMT process that has taken place; finally, 30 **WUA Legislation Profiles** representing 29 countries, were prepared by the FAO Development Law Service and include legal and supporting regulatory framework for WUAs. All these documents are available at the website mentioned above.

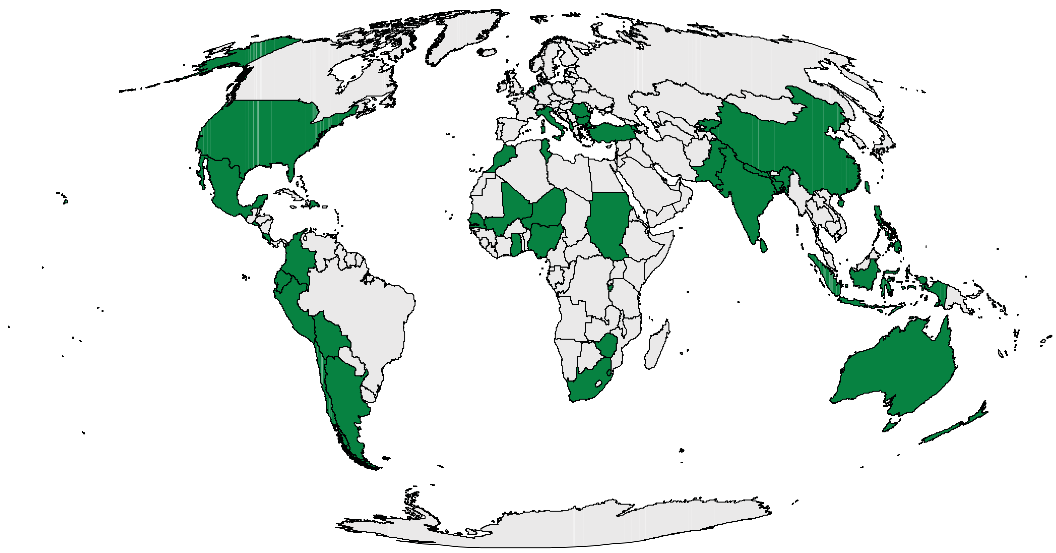


Figure 1. Map of countries represented in the study

2. POLICY AND LEGAL FRAMEWORK FOR IRRIGATION MANAGEMENT TRANSFER

2.1. RATIONALE FOR ADOPTING IMT

One of the most remarkable things about IMT is its relative similarity across different parts of the world. This is partly due to the basic need for sustainable irrigation management under declining levels of government investment. It is also due to the similar ways whereby the technical, agricultural, organizational and economic aspects of irrigation systems must interact with each other to ensure productive and mostly self-sustainable management. The FAO/IWMI database of IMT Profiles provides data on key factors that motivated adoption of IMT in 43 locations around the world (see Table 1).

Table 1. Factors motivating adoption of IMT

Factors	Number of countries where factor is:	
	Most important	Second most important
Shortage of government funds to allocate to irrigation O&M	24	6
Poor maintenance of irrigation systems	5	13
Government could not collect enough fees from water users	4	11
Part of general liberalization policies of government	3	0
Poor operation of irrigation systems	2	2
Farmers requested to take over management of schemes	2	4
Donors and international agencies	2	0
Political transition in Former Soviet Union Countries	2	0
Pressure from central department (such as planning or finance)	0	3

2.2. POLICY AND LEGAL BASIS FOR IRRIGATION MANAGEMENT TRANSFER

Where irrigation agencies are strong and/or transfer policies are modest, IMT policies can be adopted by the sectoral line agency, as was the case in 26 of the 45 cases of IMT from the survey. However, in 20 cases the policy was adopted by the head of state and in 19 cases it was adopted by an act of parliament or the legislature. In 15 cases the policy was issued by a cross-sectoral department such as the finance or planning ministry. Table 2 shows the extend of authority transferred to farmers' organizations.

Table 2. Authority transferred

Function devolved	Number of countries where authority is:			
	Fully devolved	**Partially devolved**	**Not devolved**	**Total**
Operations	31	12	0	43
Maintenance	30	13	0	43
Finance O&M	21	19	1	41
Can apply sanctions & resolve disputes	20	20	0	40
Can develop cooperative business	17	9	9	35
Finance rehabilitation & modernization	10	18	9	37

IMT occurs at different hydraulic levels of irrigation systems. In most cases (25) IMT is implemented up to the distributary or secondary canal level. In ten cases IMT included main and branch canals and in another ten cases it includes the entire system, including the headworks (i.e., dam or weir). In some cases, where IMT was, in the beginning, officially declared to be implemented up to the main system level, subsequent experience has shown a reluctance to do this for large-scale systems. Political resistance (mainly from irrigation agencies) and technical/financial challenges for farmer organizations can make this level of transfer more problematic.

Another key policy issue for IMT is the question of what kind of governance and/or management entity will take over authority and responsibility for irrigation management after the transfer. While there is a variety of potential types of organizations, by far the most common type is the WUAs, to which management was transferred in 39 cases. Management was transferred to irrigation districts in five cases. Districts often have a higher level of legal recognition than WUA, including receipt of water rights, legal status as a semi-municipal entity, and infrastructure property rights. In three cases mutual companies took over management. Generally, these are companies owned and governed by farmer shareholders. Public agencies may also transfer management to local governments (Turkey), public utilities (France), joint government/farmer organizations (Sri Lanka) and limited responsibility societies (Mexico).

In small irrigation systems or in distributary and tertiary blocks of large systems it is common to see WUAs that handle both governance and management functions after transfer. By **governance**, it is meant mobilization of authority, adoption of policies, and selection and supervision of key management staff. By **management**, it is meant the mobilization of staff and resources to deliver those services mandated by the governing authority. In larger systems or at higher hydraulic levels it is common for WUA to handle only governance or oversight functions while professional staff or third party companies handle day-to-day management tasks. However, in countries as diverse as Nepal, China, the USA and Taiwan, WUAs hire and manage their own staff and mobilize farmers for occasional maintenance works for systems as large as between 10,000 and 100,000 ha.

2.3. POLICY AND LEGAL BASIS FOR WATER USERS ASSOCIATIONS

In most cases the institutional framework is only partial at the time of policy adoption and is elaborated further over time. The study shows that the most common key policy and institutional features of WUAs that have been adopted are: the right of WUAs to use and obligation to maintain irrigation infrastructure, the legal authority to set and enforce sanctions against errant members, arrangements for settling disputes, policies and means to reorient the mandate of the irrigation agency and redeploy its staff, an arrangement to extend technical advisory services to WUA, water rights for individual water users, and a right for WUA to develop businesses (such as for input provision and agri-business) and make profits (although this is restricted in many countries due to the requirements that WUA maintain a tax exempt status). The most common of the legal rights that have been granted by governments to WUAs include the rights to enter into contracts with third parties (including the government) and hold bank accounts (18 cases), the right to levy fines against members (17 cases), and the holding of a water right or water use right (15 cases). In 11 cases WUAs have a legal provision to own property. For public irrigation systems transferred to WUAs, those which obtain ownership of irrigation system infrastructure were only three cases in Latin America (Argentina, Chile and Costa Rica), two cases in Europe (Bulgaria and Romania), and one case in Africa (South Africa).

In all cases, WUA have a general assembly of members, an executive council of representatives and a chief executive officer. In 19 of 24 cases the WUAs can federate to higher than base levels. WUA in most cases are simple organizations that lack significant checks and balances to prevent misuse of power within them. WUAs had audit committees in only seven cases of the 24 cases reported.

One issue of growing concern is that of the role of gender in membership and management of WUA. Inequalities occur where women play significant roles in water use or management and have key interests in irrigation management but are not represented in the WUA. And yet people often find it easier to place trust in women when they are not perceived to have significant roles in factions. In some cases, such as Turkey and Nepal, efforts are being made to include women more in WUA boards and in WUA positions, including treasurer and WUA head.

2.4. IMT AND FINANCING IRRIGATION

Regarding the issue of how IMT programs themselves are financed, the survey indicated that in 19 countries financing for IMT programs came primarily from international investment or IFIs' funds. In 15 countries IMT was financed primarily from national funds. In 5 cases IMT was financed roughly equally between international and national sources of funding. In most cases where international assistance is involved some grant funds are also provided by bi-lateral public or NGO sources. This is particularly done in the early stages of reform to conduct pilot testing and derivation of a methodology appropriate for national dissemination.

2.5. REFORM OF IRRIGATION AGENCIES

Irrigation departments tend to resist IMT when they perceive it to be a danger for their jobs, budgets or decision making powers. Irrigation agencies may be able to reassign their staff to higher hydraulic levels (above the level of transfer), to relocate staff to systems where IMT is not taking place, to assign them to other functions than irrigation O&M, or to have staff deputed to work for WUA (as has happened in Andhra Pradesh and Madya Pradesh, in India). Table 3 displays the main roles that government irrigation sector agencies continue to play during and after IMT has occurred.

Table 3. Roles of government relative to WUAs and water users

Roles	Asia (11)	Latin America (7)	Africa (3)	Europe (3)	World-wide (24)
Make policy, laws, strategy, plans about WUAs	11	7	3	3	24
Establish WUAs & approve WUA statutes	11	7	3	3	24
Regulate, supervise & inspect WUAs	11	6	3	3	23
Provide technical assistance & training	10	3	3	3	19
Construction & rehabilitation	10	2	2	2	16
Manage main system/large systems	9	3	2	1	15
Help settle disputes	7	4	2	0	13
Grant water allocations & concessions	5	6	1	1	13
Conduct technical & management audits	6	3	1	1	11
Arrange maintenance contracts with WUAs	4	0	0	1	5
Approve WUA O&M plans & budgets	1	2	1	0	4
Sets water service charges	3	0	0	0	3

In cases where the government retains a close role in irrigation management, the irrigation agency may arrange maintenance contracts for WUAs and review and approve WUAs' O&M plans and budgets. In countries where governments prefer to retain a common level for water charges between different irrigation systems it may continue to set water charges.

2.6. IMPROVEMENTS NEEDED IN THE INSTITUTIONAL FRAMEWORK

Experts who provided the IMT profiles were asked what policy and institutional problems and issues arose during IMT or remained thereafter. The most commonly mentioned problem was the lack of clarity about what financial and technical assistance the government would provide to WUAs after management transfer (28 cases reported this). This is related to three other concerns about financing, which were, "Who would pay for rehabilitation or modernization after transfer?" (22 cases) and "Would farmers be unable to pay for O&M?" (8 cases). Water use rights and rights over system infrastructure were noted as unresolved issues in 17 and 14 cases, respectively. Thirteen cases reported that policy or legislation about IMT was still lacking. Eleven cases reported that there was lack of clarity about the future role and authority of the irrigation agency after transfer. These were all key issues needing further consultation, negotiation and agreement with the stakeholders involved. They give an indication as to the extent of complex issues that accompany an IMT reform process. They suggest how important it is to provide extensive negotiations and opportunity to build the institutional framework and common support for IMT.

3. IMPLEMENTING IRRIGATION MANAGEMENT TRANSFER

3.1. MOBILIZING SUPPORT AND PUBLIC AWARENESS

Normally, an IMT programme is supported and developed initially by a small group of proponents, being government officials, NGO's, technical experts and IFIs. The most common main source of support for IMT is central government at the national or provincial level (32 cases). There is a larger number of sources of support than might be expected and surprisingly, perhaps, the irrigation agency was identified as a main source of support in 25 cases. Farmer organizations (19 cases), IFIs and international technical agencies (16), legislatures or parliaments (14) and local governments (9) were also significant sources of support for IMT programs. Support was also generated by pilot projects and the media.

3.2. IMPLEMENTING MANAGEMENT TRANSFER

From data obtained through the present study, it can be seen that the most universal steps taken during IMT implementation are creation of WUA, democratic selection of WUA leaders (though this is problematic in practice), technical training in O&M both for WUA leaders and their staff, farmer participation in identifying and contributing to repairs or rehabilitation, training of WUA leaders and staff in administration and finance, and training of agency staff in how to create WUAs, build their capacity and provide them with technical advice.

The resistance of the irrigation agency to IMT is the most commonly reported problem when implementing IMT as it was reported by 31 of 44 cases. This was done either in terms of slowing it down, making it more modest in scope or stopping it. This was the case in the majority of countries in Asia, Latin America, Africa and Eastern Europe. However initial resistance often switches to support later on, after negotiations and adjustments are made to protect some of the interests of agency staff.

Other problems or issues that arose during implementation of IMT included disagreements over whether WUAs should be profit making or not (*Colombia, Morocco, Romania*), late or poor disbursement of funds for IMT activities (*Ecuador, Andhra Pradesh in India, Indonesia*), lack of markets for private sector providers of support services for WUAs (*Niger, Tunisia, Argentina*), difficulties getting WUAs registered as legal entities (*Rajasthan in India, Indonesia*), problems caused by WUAs not being based on hydraulic boundaries (*Armenia, Indonesia*), and cumbersome government procedures to implement IMT (*Orissa in India, Sri Lanka, Indonesia*).

Table 4 below summarizes the key lessons learned from implementing irrigation management transfer. In addition to these points, respondents also mentioned the following: there is a need for a market of O&M service providers that can be acquired by contract or hiring of staff (*Argentina and Niger*), farmers need to have free crop choice in order to be able to support IMT (*Indonesia, Sudan and Uzbekistan*), and different forms of support services are needed for large commercial farms and small subsistence farms (*South Africa*).

Table 4. Key lessons learned about irrigation management transfer

Key lessons learned	Asia (21)	Latin America (7)	Africa (10)	Eastern Europe (3)	USA, Oceania (3)	World-wide (44)
Need clarity on roles, responsibilities, authority of WUA, agency & towns	14	5	4	1	1	25
WUA & agencies need substantial training	17	3	5	0	0	25
Need to reorient agency & handle staff disposition	14	4	3	1	3	25
Need clear legal framework	14	3	3	1	3	24
Address financial capacity of WUA along with IMT	14	3	3	2	1	23
High-level political commitment essential	13	3	3	0	2	21
Need clearer water rights & infrastructure rights	11	3	3	0	2	19
Multi-stakeholder involvement important	14	1	3	0	2	20

3.3. PERFORMANCE OF WUA AFTER MANAGEMENT TRANSFER

It is not yet clear what proportion of WUA worldwide is established democratically, functions effectively and becomes sustainable. The study offers a glimpse at the extent to which WUA are active in performing basic water delivery and canal maintenance functions after management transfer. According to the data collected, in 22 cases out of 25 reported, WUA were performing their basic water delivery and canal maintenance functions at the field canal level after management transfer. And in 17 cases out of 23 reported, WUA were performing their basic water delivery and canal maintenance functions at the distributary canal level after management transfer. In six cases only half or fewer than half of all WUA were performing their basic water delivery and canal maintenance functions. This indicates that, in general, WUA have the potential to perform their basic functions but they need sustained training, consultation, support services and a proper legal basis.

In relation to the sources of financing for WUA after IMT programs, for a sample of 27 cases, in 26 cases water charges and dues were collected by WUA from members. In most of these cases this was probably the main source of revenue for the WUA. Fines were used worldwide but were probably not a major source of revenue. Somewhat surprisingly, in 15 cases, subsidies and contracts awarded by governments and loans from public and private sources each provided revenue to WUA. In 12 cases private sector business and sales also provided revenue for WUA. Private business has not penetrated the financial management of WUA in Africa and Eastern Europe to the extent that it has in Asia, Latin America and the more developed countries.

3.4. SUPPORT SERVICES

Table 5 shows the main support services that are needed by WUA after IMT. Significantly, the top six identified were all about training and consultation.

Table 5. Support services needed by WUAs after IMT

Support services needed	Asia (21)	Latin America (7)	Africa (10)	Eastern Europe (3)	USA, Oceania (3)	World-wide (44)
Train WUA in technical aspects	19	7	8	1	1	36
Train WUA in financial aspects	20	6	6	0	1	33
Train WUA in administration	17	6	6	0	1	30
Technical consultation	16	6	3	0	2	27
Extension, agri-business, marketing	8	5	6	0	3	22
Train & motivate agency for IMT	16	0	1	0	0	17
Rehabilitation & modernization	11	1	3	1	0	16
Credit for WUA & farmers	4	2	5	0	1	12
Legal support/dispute resolution	5	3	0	0	1	9
M & E of management performance	7	0	1	0	0	8

Additional needed support services that were identified included environmental monitoring and regulation (*Colombia, Shaanxi-China, Indonesia*), crop price supports (*Nigeria, Uzbekistan*), technical/managerial auditing (*Andhra Pradesh & Madya Pradesh in India, Indonesia*), assistance to develop a capital replacement fund (*Australia, Indonesia*).

3.5. REFORM OF PUBLIC SECTOR ORGANIZATIONS

One of the changes that should go along with IMT that often does not happen is the reform of public sector organizations, especially the irrigation agency. The informants were asked, in what ways does the irrigation agency need to change, in relation to IMT. Their responses are summarized in Table 6.

Table 6. Reorientation of the irrigation agency

Ways agency reorientation is needed	Asia (21)	Latin America (7)	Africa (10)	Eastern Europe (3)	USA, Oceania (3)	World-wide (44)
Withdraw from O&M at lower hydraulic levels	19	5	6	1	3	34
Restructure/decentralize	11	3	8	2	3	27
Increased role in capacity building	15	5	4	1	1	26
Downsize/reassign staff	11	4	6	1	2	24
Increased role in providing technical & financial guidance	16	0	0	0	2	18
Increase regulation of irrigation sector	5	4	2	2	2	15
Increase management at main system & river basin levels	6	2	2	1	2	13

In addition to the above points respondents also suggested the following needs to reform or reorient the irrigation agency: increase the role of the agency in producing and communicating information to WUAs and to others in the sector (*Australia, Madya Pradesh-India, Uzbekistan*), increased role in water and agricultural extension (*Senegal, Andhra Pradesh-India*), and restricting the role of the agency to higher level maintenance and rehabilitation (*Indonesia and Bulgaria*).

4. IRRIGATION MANAGEMENT TRANSFER RESULTS

4.1 OUTCOMES

4.1.1 Operation and Maintenance Costs

The rate of collection of users' fees to cover O&M costs is often used as an indicator of the financial sustainability of a transferred scheme. A thorough assessment of the effect of transfer on the financial health of the scheme would need to consider the change in the amount of resources allocated for O&M costs before and after the transfer. In our set country profiles however, an attempt was made to understand perceptions about changes in O&M costs. In the questionnaire used, a differentiation was made between the perception of change in these costs for the farmers and for the government. The results are mixed, particularly when it refers to the change in costs to the farmers. The results are similarly distributed among those cases in which costs to farmers have increased (43% of the cases) and those in which costs have decreased (37% of the cases). Moreover, in 20% of the cases the costs to farmers have remained the same (see Figure 2). It is worth noting that it is well documented (Aw and Diemer, 2005) that even under favourable conditions often decades may pass by before farmers are in an economical position to take full responsibility over the operation and maintenance costs of the schemes.

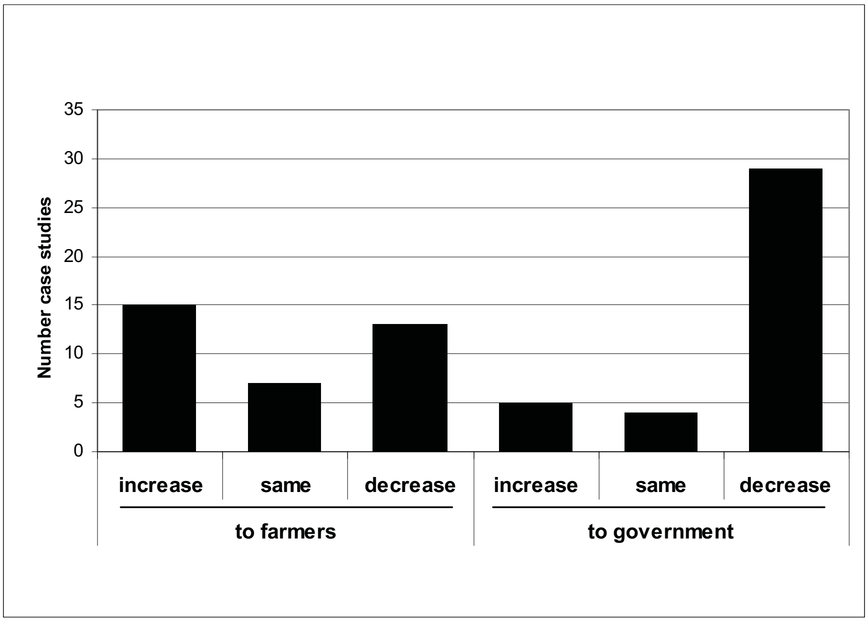


Figure 2. Changes in O&M costs after IMT

From the data collected in this study, it cannot be argued that the IMT process will necessarily result in a decrease or increase in costs to farmers. On the other hand, in the majority of cases (76%) the costs of O&M to the governments were perceived as decreasing and in 11% of the cases has remaining unchanged.

These mixed results may just reflect the fact that irrigation schemes are quite different from one another in respect to their O&M costs and in the intensity and complexity of the management they require to operate and be maintained properly.

4.1.2 Quality of Maintenance

Out of the 43 countries surveyed, only four reported that the quality of maintenance had decreased after IMT implementation. It is significant to mention however, that all four cases are in Africa. The situation that emerges from some of the African countries included in the survey is that governments have drastically decreased their contribution towards O&M and farmers have not been able to increase their share in the same proportion. The most obvious consequence of this situation is an accelerated deterioration of the infrastructure. There are some positive outcomes in Africa as well. The Sudan case study describes how after the transfer of management, farmers increased their in-kind contribution by dedicating more time to the seasonal maintenance. Another positive case comes from Mali, where the Office du Niger irrigation scheme has undergone a profound change through a comprehensive process of reform.

4.1.3 Rate of fee collection

In 75% of the cases studied the rate of fee collection increased. This result is particularly remarkable as it has occurred despite higher water fees in some cases.

There were only three cases out of 43 in which a decrease in the rate of fee collection was recorded. From these results, it can be argued that in most cases farmer organizations taking over the management of their schemes have been able to improve the water delivery service, as otherwise it is unlikely that users would pay increased fees more willingly than in the past. However, farmers' willingness to pay is not only related to the quality of the service provided but also to the existence of control mechanisms and transparent water-pricing methodologies.

4.1.4 Timeliness and Equity of Water Delivery

Timeliness of water delivery is one of the indicators that reached high consensus in the countries studied (See Figure 3). The results indicate that farmers are receiving water closer to the moment they need it and have asked for it. As mentioned above, this is partly due to better maintenance but especially to simpler operational practices and improved communications. It is worth noting that the positive change in timeliness is reported from all regions surveyed. A similar situation emerges in relation to the equity of the service provided to farmers, meaning that users located towards the tail-end of canals were receiving a better share of the water resources available. It could be argued that such a clear improvement in these two indicators is, per se, a good enough reason to advocate for the direct involvement of farmers in the governance of irrigation schemes.

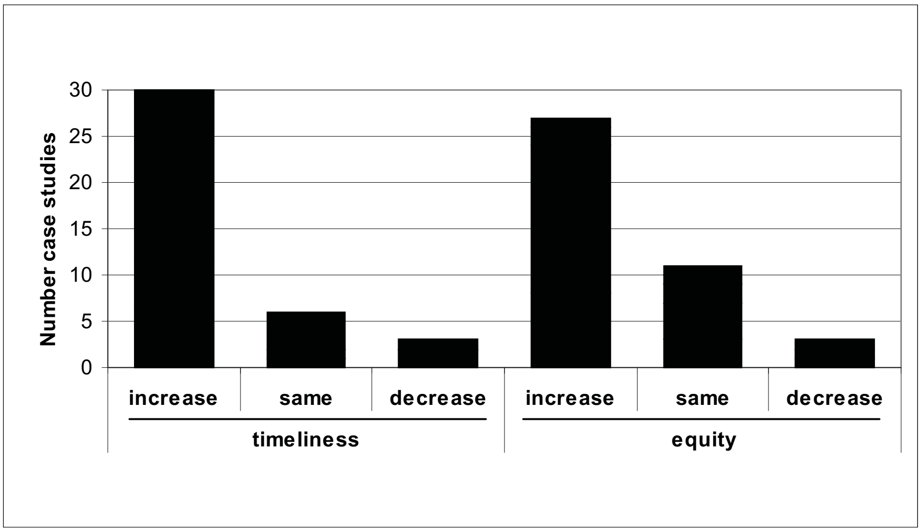


Figure 3. Timeliness and Equity of Water Delivery

4.2 IMPACTS

4.2.1 Irrigated Area

In the majority of cases studied (25 out of 39 cases) an increase in the area irrigated has been reported. During processes of reform, there may be changes in the recorded irrigated area that may not necessarily reflect actual changes in land use, but may merely bring records closer to reality (Huppert, 2005). The most important change in irrigated area during the last 15 years has taken place in several of the countries of the Commonwealth of Independent States, largely associated with their difficulty to continue funding the energy costs to operate the irrigation schemes and due to their deterioration for lack of maintenance. The incipient reforms taking place in the region have already shown potential to increase area under irrigation, as the Kyrgyz Country Profile reports. Due to the high heterogeneity of irrigation practices in the region this potential is still to be proven under different circumstances.

4.2.2 Crop Yield

It is not possible to identify distinctively the effects of the reforms in the irrigation sector in crop yields from the many other factors that may affect their seasonal value positively or negatively. Sudden changes in crop yield may stem among other reasons from major technological changes (positive or negative) or from political decisions not related to water use (i.e. changes in access to fertilizers). There are also other elements in crop yield changes that may have a small but cumulative effect over time on crop yields, like the release and adoption of improved varieties, the up taking of improved agricultural practices and overall improved management. Notwithstanding, 21 out of 34 replies of the survey reported an increase in crop yields, while another 11 informants saw no change. Most of the cases showing an improvement in crop yield are from Asia. Arguably, improvements in crop yield may be due to the normal positive trend in crop yield changes registered in Asia during the last four decades not related to IMT. However, an important result is that the information collected did not show a decrease or stagnation in crop yields in areas where water management is being taken up by farmer organizations.

4.2.3 Farm Income

Farm income is not a good performance indicator for IMT processes as it summarises the effects of issues such as the ability to produce the adequate crops, access to inputs, access to markets, access to transport facilities, farmer's managerial skills, etc. Policies and management decision have an important bearing on farmers' economic performance, but to single out the causes for its fluctuations is rather difficult and would require much more detailed data than what was collected through the questionnaire developed for this survey.

During the process of IMT farm income may increase due to a number of reasons. If things were to evolve according to the common features included in an IMT process, fee collection will improve and more money would be available for operation and maintenance activities, which would result in better water delivery service. Under an improved situation, having water timely and in the adequate quantities would mean, other factors being equal, that yields could be increased or the quality of the produce improved. If there are no other major limiting factors, this higher production would in turn have the potential to increase farm income per hectare.

When looking at these three indicators together, namely, irrigated area, crop yield and farm income, the results of the survey show a clear tendency confirming the afore-mentioned statement. Most countries reported higher irrigated areas; increased crop yields and increase in farm income (see Figure 4).

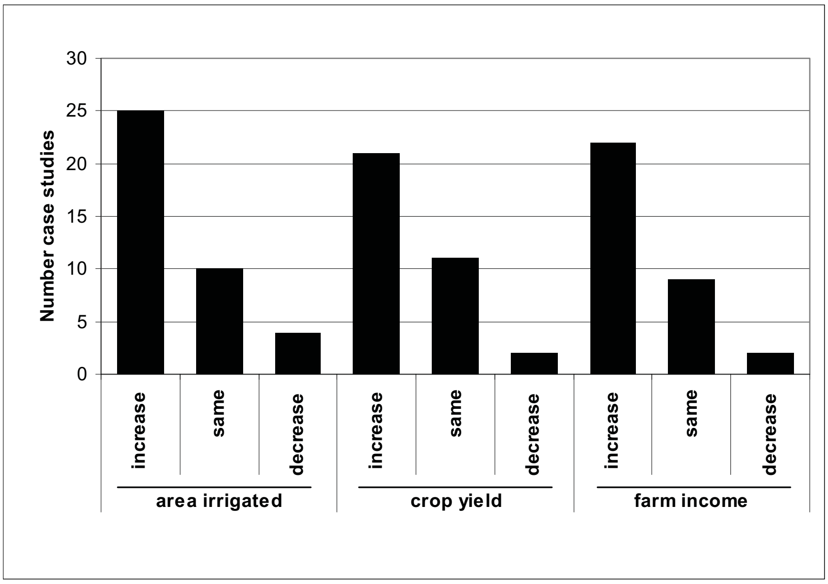


Figure 4. Changes in area irrigated, crop yield and farm income

4.2.4 Soil salinity and waterlogging

The information collected through the questionnaires and case studies in relation to soil salinity and waterlogging is limited as in few cases these situations exist or are recognised as an issue. However, out of the 15 countries which reported waterlogging as an issue, seven reported it has decreased after the introduction of IMT and only one country reported it has increased. The remaining seven countries reported no change.

5. CONCLUSIONS

This section summarises the findings of this survey and provides insights into the areas that pose risks, approaches that have proven valuable and negative experiences as well.

1. **Emerging types of IMT models and programs**: As the IMT process gains momentum across the world, several international bodies tried to develop an ideal IMT model that could be easily implemented anywhere in order to facilitate and promote the implementation efforts. What is now perceived from the evidence is that it is not possible to design a model that can cater to different physical, institutional and socio-economical conditions that are evident not only across regions and countries but often also within countries themselves. Notwithstanding the above, there are certain common elements of IMT programmes that can be found in a broad number of situations. The following statements are a case in point:

   - IMT programs need to be clear about the roles, responsibilities and authority of WUA and irrigation agencies after transfer. The information collected shows that there is a tendency to grant WUA responsibilities without sufficient, legally-recognized authority. Governments should develop clear and comprehensive policy and legal frameworks that sufficiently empower WUA to accomplish their purposes.

- IMT programs should include the important need to reorient the irrigation agency and plan how to support agency staff to adapt to the new situation. Without this, agencies tend to resist IMT and may sabotage its implementation. As a minimum, agencies need to redeploy staff from transferred canals and build their capacity to train, establish and strengthen WUAs. They may also need to intensify their roles in management of main canals in large schemes, sector regulation and river basin management.

2. **Main IMT constraints and how to overcome them:** From the information collected in this survey it can be seen that in some cases countries started the adoption of IMT programmes without a thorough previous analysis to evaluate the existence of adequate conditions to support the process. Following are some considerations emanating from the results of the survey:

   - There is a widespread need for clearer water rights to be given to WUAs. In many parts of Asia and Africa water rights do not exist or they are not functional. Farmers may need greater confidence in their water rights before they will be willing to take responsibility and make investments to ensure the productive and sustainable use of the infrastructure as well as of agricultural inputs.

   - Oftentimes, government financial support fell short of IMT needs. Many of the cases in this survey were clearly under-funded which led to insufficient support for important issues such as a promotion campaign to facilitate the implementation process, building the capacities of WUAs and irrigation agencies, addressing land and water rights and adjustments in agricultural support services.

3. **IMT as a mechanism towards an improved integrated water management approach:** This reform has provided an opportunity to bring together a range of actors at various levels that did not use to communicate often about the problems faced by irrigated agriculture. Because of the inclusive nature of the transfer process that cuts across policy, legal, institutional, technical and socio-economic matters, it provides a venue for discussion on how to tackle water resources management in a broad context. Some issues to consider follow:

   - IMT programs require the support of stakeholders such as local governments, the private sector and civil society to be able to reach its intended goals.

   - There is no strong evidence that the IMT process leads to an automatic improvement in water distribution at any particular level of the system. However, there is ample indication that communication between system management and end-users has increased which creates a better understanding of the water distribution process and its requirement which translates into enhanced satisfaction of the service provided and received by each party.

4. **Concept of IMT - Revised objectives and expectations:** As it could be expected from any complex reform process, there are implementation aspects that lead to partial or non-achievement of original objectives. The aspects mentioned below summarise the main issues in relation to achievement of IMT objectives coming from this survey:

   - Overall, the results of the IMT process undertaken across the globe can be perceived as a mix of successes and failures. Now that the process is better understood and its implementation has taken hold, efforts should concentrate now on the Monitoring & Evaluation component of the process.

- IMT has partially achieved government objectives. Even though some of the main objectives of governments at the onset of the process have been achieved, in some cases this has been coupled with the government's disengagement from irrigated agriculture, hampering the provision of some support services basic to the agricultural sector. The expectation that the private sector was going to become involved in the provisions of some of these basic support services has not been fulfilled.

- The performance of water services fee collection has been erratic. Initially, in a good number of cases IMT has led to significant increases in the fee collection ratio but it has not always been sustainable. There are large variations between irrigation systems within the same country and among countries. It has not been the silver bullet that was originally presented as one of the main reasons for introducing the reforms.

- Democratic selection of WUA leaders is problematic and is often not achieved. Not in all cases internal WUA statutes provide enough safeguards for small farmers to be adequately represented.

5. **Recommendations towards future IMT programs:** From the previous paragraphs in this section, it is possible to draw some lessons emanating both from the survey and other experiences gathered from other efforts concerning the transfer of management that should be taken into consideration by those governments or entities that are engaging or about to engage in this type of reform:

- WUAs and irrigation agencies need substantial and prolonged capacity development. Commonly, IMT programs provide training and other complementary activities to WUAs only during their establishment, but many survey respondents say that all these activities should be part of a long-term programme that eventually evolves into a consultative, problem-solving process. Many irrigation agencies lack knowledge and experience in assisting WUAs to organize and manage their new responsibilities.

- IMT programs generally need systematic public awareness campaigns, consultations and involvement of all key stakeholders. This helps farmers to see that IMT is a programme with broad recognition, legitimacy and support. Where irrigation-related disputes exist, consultations with stakeholders may be needed to work out acceptable solutions.

- IMT should be tailor made and flexible. There is a tendency for IFIs-promoted IMT programs to adopt fixed institutional arrangements and implementation schedules. When complexities and issues arise during implementation they may cause governments to skip over negotiated settlements or establish WUAs rapidly and undemocratically.

- Checks and balances should be created to ensure that WUAs act according to members' interests. This may include a variety of measures, such as requirements for approval by WUA members of irrigation management plans, budgets and fees; WUA officer recall provisions in WUA by-laws; and irrigation management audits.

- The studies have not provided any direct evidence that the IMT process has translated into a negative environmental impact on the systems involved. At worst, the effect, particularly on salinity and waterlogging, has been neutral meaning no deterioration has occurred or it has remained as prior to IMT.

6. REFERENCES

1. Aw, Djibril and Diemer, Geert, 2005. *Making a large irrigation scheme work: A case study from Mali.* The World Bank. Directions in Development Series. Washington, D.C.
2. Huppert, Walter, 2005. *Water management in the "Moral Hazard Trap" - The example of irrigation.* Paper presented at the Seminar on "Corruption in the water sector: How to fight it?". World Water Week 2005. Stockholm. http://www.siwi.org/downloads/WWW-Symp/Water_Management_Huppert.pdf
3. Plusquellec, Herve. 1999. The role of the World Bank and new opportunities. In FAO: Modernisation of irrigation system operations. pp. 13-19. Bangkok
4. Sen, Gautam. 2000. Is globalisation cheating the world's poor? The First Press. www.theglobalsite.ac.uk

EQUITABLE DISTRIBUTION AND COMMON RESOURCES MANAGEMENT AT ANDHI KHOLA IRRIGATION SYSTEM

Padma Prasad Aryal[1], Dinesh Rajouria[2]

ABSTRACT

Water resources being one of the major natural resources of Nepal, culturally, economically as well as geographically it plays an integral and vital role in the agriculture based economy that supports 40% of the GDP with more than 80% people's involvement in the sector. Land fragmentation coupled with small land holdings, and uncertainties in land tenure regulations are identified as some of the confronting factors in the process of agriculture development in the country.

Land pulling from the larger landholders with their consent and distribution of land in accordance with the water right shares earned during the construction of the irrigation project has addressed the poverty to a larger extent and the effort made by Andhi Khola Water User's Association (AKWUA) is commendable. This indigenous practice of water right provided an opportunity to even the land less family of the command area to earn land by contributing labor during the construction of the project. This indigenous practice has provided land to the 15 landless and 56 marginal farmers' family.

The water right shareholders can even sell their share of water to the person in need with in the command area. The out come of the strategic management and implementation of this irrigation project has not only resulted in the decrease of migration but it has improved the economic condition of the people. Increase in the crop production and economic activities has attracted establishment of boarding schools and mills for grain processing. The water from the Andhi khola Irrigation system has not only been used for irrigation but it is used in multiple purposes. This system is a unique model of the integrated water resources management and has been successful to address the poverty with in the command area.

1- Executive Member- National Federation of Irrigation Water User Association Nepal
2- Irrigation Engineer – Department of Irrigation, Phone: 0097715530244, e-mail: akwuas@yahoo.com

PART I

INTRODUCTION

Although UMN had been planning a water resources development program in the Andhi-khola basin (Andhi is the name of the river and Khola means river in Nepalese language) since 1963, it could not be materialized till 1980 due to lack of resources both financial and humane. In 1980, it exerted its effort to undertake a multipurpose and integrated rural development project targeted for overall development of the region. Under this project, a 5.1 MW hydro-electric project was formulated with the objective of availing electricity for rural electrification, ropeways, lift irrigation and small agro-based industries.

In 1981, an agreement was signed between the then His Majesty's Government of Nepal and the UMN for the implementation of the program. Initially, the Norwegian Agency for Development Cooperation (NORAD) provided the fund through UMN for hydro-power construction and rural electrification component only. Later following a request, the NORAD agreed to provide additional fund needed for irrigation development activities too. In 1985, the NORAD through Norwegian Himal-Asia Mission made available the fund for irrigation component. This irrigation project is called Andhikhola Irrigation Project (AKIP) that provides irrigation facility to about 282 hectares of lands. The total cost of the project at its completion was 31.8 million rupees (US $ 0.45 million). This paper now onwards will focus only on the different aspects of Irrigation development and related impacts on the socio-economic condition and its functioning mechanisms.

THE ANDHI KHOLA IRRIGATION PROJECT

THE WATER SOURCE

The arrangement for the distribution of water for both hydropower and irrigation is made in such a way that a 60 m. long and 6 m. high Ogee type weir is constructed across the Andhi-kholal that in turn diverts water through 1284 m long head race tunnel that opens up to a surge tank. This surge tank has two out lets one for the hydropower and another for the irrigation channel.

THE IRRIGATION SYSTEM

This irrigation system comprises of 9.4 km of main canals (3.4 km extended after hand over), 13 branch canals totaling to a length of 21.6 km with a network of pipelines to cater irrigation water to different patches of agricultural lands scattered around the sloping and incised topography. The construction of this system was started in 1989 and handed over to the water users organization, Andhi Khola Water Users Association (AKWUA) on 27th June, 1997.

FORMATION OF ANDHI KHOLA WATER USERS ASSOCIATION (AKWUA)

In line with one of the prominent objectives of the project, which was the uplifting of the poor and landless farmers in the command area through active participation in the development of the project a representative body of the affected farmers was formed as early as in 1984 and registered under the association registration act. There are three committees under AKWUA that are legally tied up with the AKWUA statute. There major responsibilities and extent of works are described below:

1. AKWUA EXECUTIVE BOARD:

This board is comprised of 13 members with at least 33% of women members. This board is chosen through the direct election from the share holders. The election is held every year, however, the each election replaces only the 50% of the members that have completed 2 years tenure. This arrangement is made in order to make cohesion with the newly elected members and make sustainable governance. The executive body is not only responsible for the daily activities of the AKWUA office and its employees at the same time, it is the main body that looks after the over all operation and maintenance, service fee collection, budget allocation, water distribution and resource mobilization with in the system. This committee is mandated to take all the major decisions and is responsible to make cooperation and coordination with the major stakeholders and funding agencies both governmental and non-governmental. Regular monthly meeting is held of the executive body.

2. EVALUATION AND MONITORING COMMITTEE

This committee is comprised of one chairperson and 10 members elected directed from the share holders. The election for this committee is held every year for its all 11 members. This committee is mandated to monitor and evaluate the activities carried out by the executive committee and make suggestions and recommends for further betterment. This committee submits the report of its evolution and findings to the executive board every six months.

3. LAND PURCHASING AND REDISTRIBUTION COMMITTEE

This committee is comprised of one chairperson and 6 members. All the 6 members and the chairperson are nominated by the executive body. This committee is mandated to keep the records of the land and water share of the individual. The trading of the water share can only take place after the recommendation this committee to the executive body.

FORMATION OF ANDHIKHOLA MULTIPURPOSE ASSOCIATION (AMA)

With the main objective of providing sustainable support to AKWUA a new organization in 2005 has been registered. This organization is comprised of AKIP shareholders and representative from Butwal power Company (BPC) that owns the hydropower. This organization has 500 general members. It also has an executive body comprised of 5 elected members out of water shareholders and 2 representative nominated by BPC. BPC has agreed to provide Rs. 250000.00 per annum to AKWUA through this organization for institutional development of AKWUA. After formation of this organization BPC has waved the share of the cost (20%) that AKWUA used to pay to BPC towards the maintenance to head works and headrace tunnel. This organization is active in attracting fund from donors. So far the fund collected by this organization amounts to rupees 577774. It releases the fund to AKWUA as and when requested.

ROLE PLAYED BY THE AKWUA AND MODALITY OF IMPLEMENTATION

The AKWUA has worked closely with AKP/ UMN staff in implementation of the irrigation project. It has been much instrumental specifically in mobilizing local human resources during construction, and executing necessary task of land purchasing and redistribution program of the project. Fig. 1 presents the external and internal support mechanism that the AKWUA has established. Some of the prominent areas wherein the AKWUA has contributed are discussed below:

SHARE EARNING:

As stated earlier, any person residing in project area could earn a share by contributing 5 days labor contribution (worth Rupees 165 equivalent to US $ 2.32). A person was entitled to earn a maximum of 4 shares. There was a provision of 25000 shares to be distributed to the beneficiaries. Possession of the single share would give the owner a water right of 1/ 25000 part of the water flow available at the head (which would mean 688 lit/sec divided by 25000, equals to 0.027 lit/sec). Calculating at the rate of Rupees 165 per share the total contribution that was expected from the beneficiaries farmers was worth rupees 4,125,000. However, by the end of the project i.e. hand over date the shares earned by the beneficiaries were only 17739 worth rupees 2926935. Since the UMN had spent money in lieu of labors for rest of the contribution the UMN kept rest of shares, 7,261 within it self. However, in year 2000 the share kept by UMN was handed over to the AKWUA. So far AKWUA has sold 1056 shares out of 7261 and remaining 6205 shares are still in the possession of AKWUA. In order to sell the remaining share AKWUA is thinking of revising the quantity of water per share.

ASSESSMENT OF WATER NEED

The AKWUA notifies to the user farmers register their shares with in certain date before each cropping season. They share holders are required to mention the canal from where he /she needs water. Based on such registration, the AKWUA calculates the discharge needed and it requests the Hydro power to release water for irrigation from the surge tank. The AKWUA also determines the discharge required to each canal (Main, branches and tertiary) based on the prior registration.

LAND RE-DISTRIBUTION

One of the major objectives of this project was to collect some lands from the rich farmers and then distribute to the land less. The basis for determining and optimum land requirement for livelihood was based on the assumption (postulated by Joy Poppe, 1982, Socio-Economic Survey) that a family with 7 members would need a land area of 5 Ropanis (0.25 hectares). This would mean that one person would need approximately 11.5 anna (0.036 hectares). As a result of this, the project made criteria that farmers having more than 0.036 hectares per person would require to sell 10% of their extra land to the AKWUA. Such purchased land pieces would then be distributed to the poor or landless farmers at the same pre irrigation price.

To date, AKWUA has been successful to purchase 232 Ropani (11.6 hectares) of land and also has already distributed this land to 71 poor/landless and marginal farmers. The rate for buying and selling of the land by the AKWUA was decided according to land category which is shown in table 1. While the money was fully paid to the seller, the eligible buyers were allowed to pay in installment basis of five years with out any interest. For this purpose of land pulling and subsequent payment to the seller, UMN had provided a refundable fund to the AKWUA which later on waved by the UMN to the AKWUA for its institutional development.

Table: 1. Land Price

S.No.	Price (Rupees/ropani)		
	Land Slope	Before 1990	After 1990
1	0^o - 10^o	2000	3000
2	10^o -20^o	1800	2800
3	20^o - 30^o	1600	2600

IRRIGATION SERVICE FEE

Each shareholder or beneficiary farmers are paying rupees 6.0/share/year for office expenditure of AKWUA. Besides this the shareholders are paying rupees 4/share/year for maintenance and operation of the canal system. The shareholders are also shouldering a portion of maintenance expenditure of headwork and tunnel (20%) to the hydropower company. At present 15000 shares are active and utilizing water for irrigation and paying the O& M as well as office expenditures. Besides the above the AKWUA also mobilizes some labor contribution from each shareholder for canal cleaning and reshaping. There are some prior agreed rules and procedures for such labor contribution. Therefore, the canals are generally cleaned twice in a year that is before paddy transplantation and wheat sowing.

CONFLICT MANAGEMENT

The AKWUA board has been successful to resolve conflict so far. There has been no conspicuous related to water allocation and distribution. The AKWUA has rules whereby any person or shareholder who does not abide by the rule are normally penalized by depriving him of irrigation water or requiring him to pay fine of some amount.

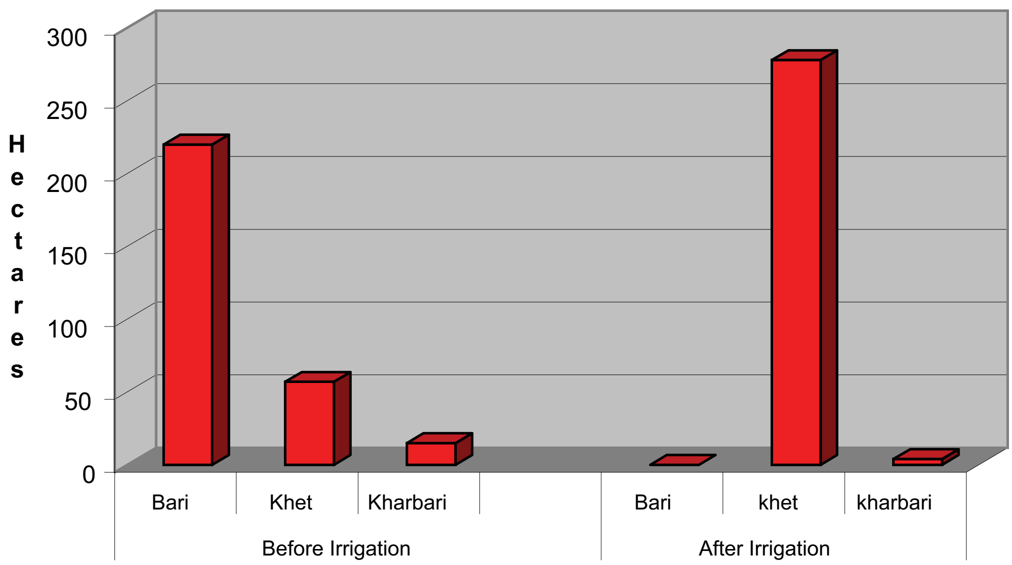
PART II

THE COMPARATIVE STUDY

LAND TYPE OF THE COMMAND AREA

Basically the land in hills is classified into three types- “Khet” – terraced, irrigated land; “Bari” – unirrigated land that is sometimes terraced; “Kharbari” – an area of seemingly waste land which is cut for fodder. The Figure 1, below shows the comparative status of land type with in the command area. It is note worthy that the farmers have worked hard to convert their sloping land into terraced land in order to grow rice and take full advantage of irrigation. This terracing of land has not only added value to their property but also the soil erosion has been checked to a larger extent.

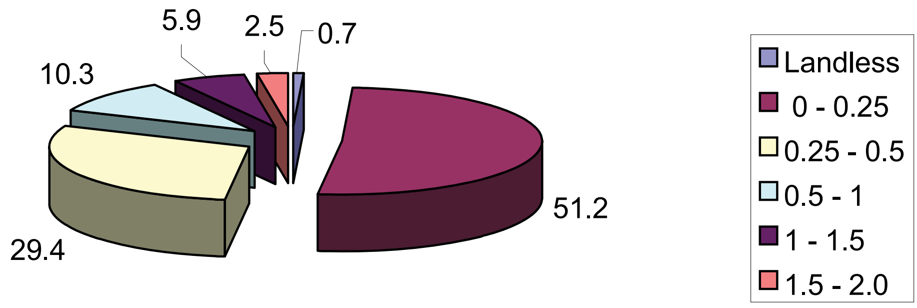
figure :1 Land Type



LAND HOLDING

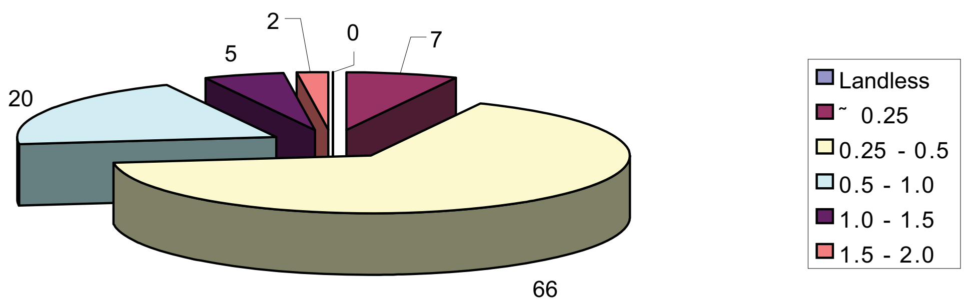
There has been a significant change in the pattern of land holding as a result of land pulling from the larger land holders and redistribution to the land less and marginal farmers. The figure 2 and 3 show the comparative pattern of land holding.

Figure:2 Land holding (ha) Before Irrigation
% household



Source: Joy Poppe, 1982 Socio-economic Survey

Figure :3 Land Holding After irrigation
% Household



Source : AKWUA Yearly Report 2005

FOOD SUFFICIENCY STATUS

Rain fed paddy and maize were the dominant crops grown in the area. After the irrigation facility, farmers are producing more paddy, wheat and the vegetables such as tomatoes, potatoes, cauliflower, cabbage, onion, garlic and green leafy vegetables. Generally, maize and millet are grown in unirrigated "bari" land. After the availability of irrigation, major part of the bari and meadow has been converted into rice fields and thus the production of maize and millets has gone down considerably. More and more farmers are attracted towards the vegetable farming due to availability of agricultural inputs in the local market and the agriculture extension service nearby. Tables below show the comparative production status of different crops:

Comparative Crop production

Before Project		In year 2005	
Crops (Rainfed)	**% of Gross Production**	**Crops (Irrigated)**	**% of Gross Production**
Paddy	38.70	Paddy	60.77
Maize	30.77	Maize	10.90
Millet	16.90	Millet	0.85
Wheat	7.28	Wheat	15.37
Potato/Vegetables	3.16	Potato/Vegetables	9.37
Pulses	2.33	Pulses	1.51
Mustard	0.86	Mustard	1.23

The average grain production per person per annum has increased from 3.83 muri (Approx 268 kg) to 5.64 muri (Approx. 395kg).

CROPPING INTENSITY

Due to the non availability of irrigation water only the long duration crops were grown as a result of which, farmers were able to grow only two crops per year. The average cropping intensity then reported was merely 150%. However, due to availability of short duration and quick yielding varieties most of the farmers are harvesting 3 crops a year resulting into the 288.8% of cropping intensity in the year 2005.

CROP YIELD

No large increase in crop yield was reported in the earlier years and it is believed that this might have happened due to the loss of fertile top soil while converting the bari (sloping land) into Khet (terraced land). However, in the recent years the average yield of summer paddy is 3.1 mt/ha and spring paddy (cultivated only from last year) is 4.4 mt/ha. The average yields of wheat and maize are 1.8 and 1.5 mt/ha

ECOLOGICAL BALANCE

The previously rugged terrain of high slope was prone to land slide and land degradation. Deforestation of the marginal land for fodder and fuel was its peak. However, after up coming of the multipurpose project these adverse activities have been checked to a great extent. Efforts have been made towards plantation of suitable plants to minimize the threat of land slide and sheet flow of top soil. The area that looked deserted before the implementation of the project now surrounds with green vegetation giving a picturesque view. As result of this effort the project has owned the prestigious “Blue planet Award 2005". A good effort towards biodiversity and ecosystem conservation with in the project area has been made to over come the threat of land degradation.

CONCLUSION

The AKIP is a unique irrigation project in the history of irrigation development in Nepal. The modalities of design and construction, water right share distribution; land pulling and redistribution are very well thought and very appropriate ones. The project has been successful in meeting the objectives up to large extent. The unique concept of share distribution has not only instilled much farmer's contribution in the system construction but has become one of the example of equitable distribution of common resources and its management. It has helped to establish an equitable water distribution mechanism. The major success of this project lies in getting some portion of land from comparatively large land-holders and distribution of these land to land less and marginal farmers. The project has been successful in alleviating the poverty in the region. The trend of migration of the family members from the region has gone down considerably. The establishment of health centre and educational institution has provided the opportunity to the population for better health care and education. The establishment of strong and powerful water user Association is another remarkable achievement of this project towards decision making for the betterment of the farmers and functioning of project as well. This project is not only a very good example of successful integrated water resources management but also a very good coordination and cooperation exists between the management of Irrigation system and Hydropower Company.

REFERENCES

1. BPC Hydroconsult, 1987. AHREP Headrace Gravity Irrigation Scheme Feasibility Report United Mission to Nepal
2. Earnest Thiessen, 1983 AHREP Headrace Irrigation Preliminary Report- United Mission to Nepal
3. Joy Poppe, 1982 Socio-economic Survey Report, Andhi – Khola Project, UMN
4. Nepalese Society of Agricultural Engineers, 1997 Impact Evaluation Study of Andhikhola Irrigation System
5. Padma Prasad Aryal, 2004 Final Report on Effect on Rural Livelihood through Common Resource Management- International Centre for Integrated Mountain Development (ICIMOD)

The 4th Asian Regional Conference & 10th International Seminar on
Participatory Irrigation Management
Tehran-Iran May 2-5, 2007

PRINCIPLES AND METHODS FOR PARTICIPATORY IRRIGATION MANAGEMENT AND ROLE SHARING BETWEEN GOVERNMENT AND FARMERS

Dr. Masayoshi Satoh[1], Satoshi Kono[2], Tassanee Ounvichit[3]

ABSTRACT

This paper theoretically discusses the principles and methods for Participatory Irrigation Management (PIM), including the goals of irrigation management and obtaining farmers' cooperation in implementing water management systems. In addition, the principles for role sharing between governments and farmers are discussed. First, the Law of Diminishing Return is used to explain the relationship between the efficiency of an irrigation project and equal water distribution. The law explains that a governmental project has two independent goals of highest economical return and equity in irrigation management, both of which can be simultaneously realized under specific and limited conditions. Second, background is given on how to obtain the cooperation of farmers to show that cooperation is possible because of the competitive relationship of local farmers, not in spite of it. Third, the water distribution process is divided into four sub-processes of decision making, operation, monitoring and feedback. Traditional role sharing between the government and farmers' organizations is called "spatial role sharing" because lower levels of the canal system are handed over to farmers, while the main levels of the system are still totally managed by the government. Instead of the traditional method, "functional role sharing" is recommended, in which the government

1- Professor, Graduate [S]chool of Life and Environmental Sciences, University of Tsukuba, Ten-nodai 1-1-1, Tsukuba, Ibaraki, 305-8572 Japan, Phone: +81-29-853-4648,
E-mail: massa@sakura.cc.tsukuba.ac.jp
2- Graduate [S]chool of Life and Environmental Sciences, University of Tsukuba, Ten-nodai 1-1-1, Tsukuba, Ibaraki, 305-8572 Japan, Phone: +81-29-853-4899, E-mail: shitosanoko@hotmail.com
3- Policy Analysis Group, Planning Division, Royal Irrigation Department, 811 Samsen Road, Bangkok, 10300 Thailand, Fax: +66-2-669-5014, E-mail: ounvichit@yahoo.com

and farmers share functions based on the four sub-processes, according to each irrigation facility at the main, lateral or on-farm level.

1. INTRODUCTION

The world's irrigation area was 94 million ha in 1950, and tripled to 276 million ha in 2000 (Figure 1). This is a result of irrigation development, and can be viewed as a great achievement towards the more stable and increased production of food, and to contributing to the food supply for an increased population. This increase in the irrigation area is seen not only in developing countries but in industrialized ones. However, efficiency and sustainability in irrigation management are a challenge, especially in developing countries. Most of the irrigated areas in 1950 were traditional irrigation systems sustainably managed in a traditional way with farmers participating when necessary (Surarerks 1986, Ounvichit 2006). The present problems of irrigation management are mainly related to modern irrigation projects that have been developed after World War II, most of which are in Asia, Africa and Latin America, where many small scale farmers have to share an irrigation canal.

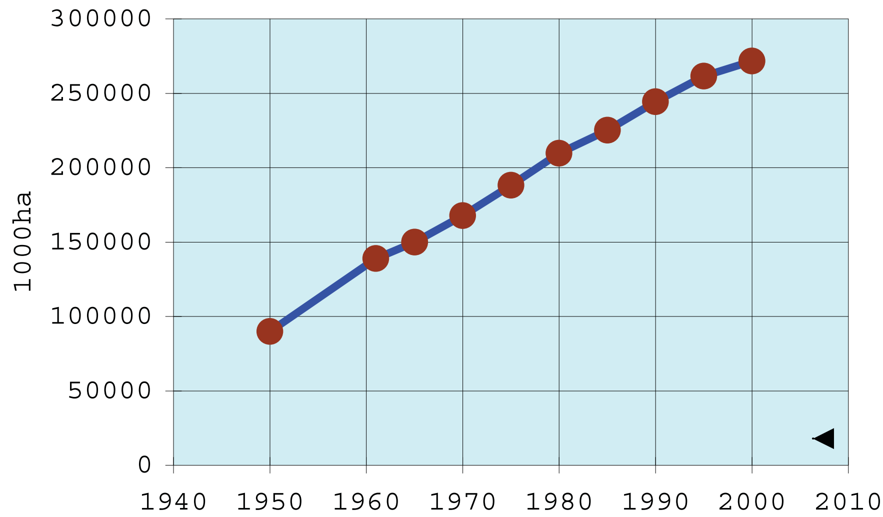


Figure 1 World irrigation area tripled during the latter half of the 20th Century (Source: FOASTAT, Brown 1999)

These irrigation projects have been initiated, planned, constructed and managed mostly by governments, but many experts now believe that irrigation systems should be turned over to local farmers to be managed by the water users themselves. Governments and international organizations around the world are attempting to implement this

"Participatory Irrigation Management" (PIM). However, it is widely recognized that the establishment of a water user's group, an essential element of PIM, and its stable management are very difficult (Vermillion 1997, Groenfeldt and Svendsen 2000).

For the success of PIM, it is critical to extract the common principles underlying successful irrigation management by analyzing experiences in traditional irrigation systems and to apply them to new and problem systems. These analyses should be carried out very carefully, because so many aspects of a country affect irrigation management. We know that a successful method in one region does not always guarantee success in other regions in other countries.

Japan achieved a rapid increase in irrigation areas from the 17^{th} to 18^{th} centuries that led to water conflicts similar to the conflicts the world is facing now. Consequently, Japan has a long history of water conflicts and resolution, and has developed its own style of managing irrigation projects. It employs a Land Improvement District (LID) system for irrigation projects, in which farmers manage their irrigation systems in an autonomous way, determining water distribution, operating the canal system, and collecting membership fees covering the entire cost of management. Thus, Japan is regarded as a country whose experiences in irrigation management deserve analysis and generalization.

This paper aims, based on the authors' experiences in Southeast Asian countries as well as in Japan, to discuss common principles for success in PIM, and to thereby present ideas that should be introduced into PIM implementation.

2. PROBLEMS OF WATER MANAGEMENT IN MONSOON ASIAN COUNTRIES

One of the special characteristics of the water management situation in East and Southeast Asian countries, including Japan, is that a large number of small scale farmers are the beneficiary of a project. Moreover, a farmer owns several plots dispersed over an area. The terminal ditches delivering water to these small plots are so small and earthen that it is impossible to measure the water used by individual farmers. Under these conditions, a water management company may not be able to run a business delivering water to each plot according to farmers' needs, unlike in the water supply sector or in large scale farming systems. The farmers inevitably have to be both users and managers of the water at the lowest level.

An important discussion point is expressed in the slogan, “From government to farmers.” The incentive of farmers for a good water management is stronger than that of government bureaucracies (Groenfeldt and Svendsen 2000). Should the ultimate goal of PIM therefore be to transfer everything to farmers? Although government officers are now the official managers of irrigation systems in most countries and are achieving very low performance, transferring everything to the farmers may not be the best ultimate goal.

A real problem is that the illegal interference and no maintenance activity of farmers with irrigation facilities are leading to uneven water distribution and rapid deterioration of the facilities. What is needed is not the simple participation of farmers, but an adequately controlled participation of farmers. If this is undertaken, who would control farmers’ participation? For what goal would someone undertake to control the farmers’ participation?

The most fundamental and even practical problem may be that most government engineers, officers of international organizations, farmers and other stakeholders have no commonly shared understanding of the goals of water management, or of why, and in what form, farmers should participate. The idea from the World Bank, “The concept of PIM refers to management by irrigation users at all levels of the system and in all aspects of management.” and “the PIM approach starts with the assumption that the irrigation users themselves are best suited to manage their own water.” (INPIM) is widely accepted. This can work as a general guideline in promoting PIM. However, there have been very few discussions on the practical goals and methods needed to achieve this involvement. We need a clear image for the course of action.

3. DIFFERENT GOALS OF WATER MANAGEMENT IMPROVEMENT FOR GOVERNMENTS AND FARMERS

Investments in irrigation development are done mostly by governments (both central and local). In particular, farmers are not requested to cover the main construction costs, with some exemptions like Japan that requests monetary contributions from farmers, for main facilities as well as for on-farm ones. In this investment, the government mainly looks for the highest economical return from irrigation development. The broader targets of a government, such as poverty alleviation and increased social stability will, of course, accompany the project (Asian Development Bank, Hussein et al. 2002). But the first and most fundamental target of water management is still to harvest the largest amount of food with the given amount of available water.

However, you have the farmers, each of whom will endeavor to make the maximum profit from the water flowing in front of them. The ability of farmers to obtain more profit is in itself a favorable thing, but not all of the farmers' goals can be realized at the same time under the limited availability of water. Farmers have to share the water. In the management of irrigation projects, farmers have a basic and rational demand, which is that they want to know the reason why a certain amount of water has been given to them at this moment, and they also want to be able to decide the amount and time of receiving water by themselves if they can. Seen in this light, we can surely say that farmers have a basic incentive for participating in irrigation management.

However, an important point to note is that the efficient and sustainable use of an irrigation project is out of the direct purpose of individual farmers' performance. An irrigation organization of farmers with such backgrounds is not easy to manage in accordance with the goals of the government. Our observations of irrigation projects in Asia and Africa has led us to conclude that the maximum benefit to the government or society is not realized if irrigation management is transferred to farmers or farmers' organization with no intervention from the government (Ishii et al. 2005, Sato and Satoh 2006). Therefore, farmers should not be allowed or expected to manage the project themselves. We should again confirm the final goal of water management improvement for the project or the society, and the methods for realizing the goals of PIM should be continuously sought.

4. TARGET OF WATER DISTRIBUTION

Let the major target of water management be to gain the maximum yield under the given irrigation conditions. Then we need to know what water distribution will gain the maximum under a given amount of water. Here, the authors introduce the Law of Diminishing Returns, which is widely used in economics. This law may be applicable to the irrigation of farmland (Figure 2). It suggests that the first one unit of water applied to rain-fed farmland has large benefits, but that the marginal benefits decrease as the water application increases, though the total benefit continues increasing. It means the relation curve for irrigation and yield is convex upward. The marginal benefit will eventually reach zero when the total benefits have been reaped. By applying this law, we understand that the maximum benefit of irrigation is realized when the available water is allocated equally among individual plots in the project area.

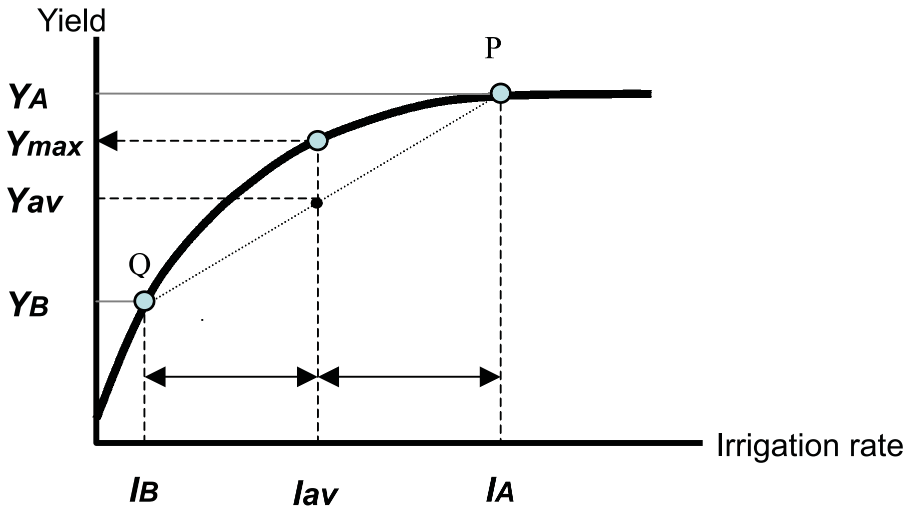


Figure 2. Law of diminishing returns for irrigation management.

A model for an irrigation project consisting of two regions, A and B, having the same areas of irrigated land is introduced as shown in Figure 3. Assume that all conditions except water are the same in both areas and that there is no water conveying loss. Let the available water W be not enough for the whole project, and distributed to regions A and B by W_A and W_B ($W_A > W_B$), respectively. The irrigation intensities in Regions A and B, I_A, I_B are obtained by W_A and W_B divided by each area, respectively. The average irrigation intensity for the whole area I_{AV} is given as $(I_A + I_B)/2$. When this relation is applied to the Law of Diminishing Returns, we know the yield in Region A Y_A is larger than that in Region B Y_B, as shown in Figure 2. The average yield for the whole region Y_{AV} is given as $(Y_A + Y_B)/2$, on the middle point between P and Q. The average yield, of course, represents the total yield in the project area.

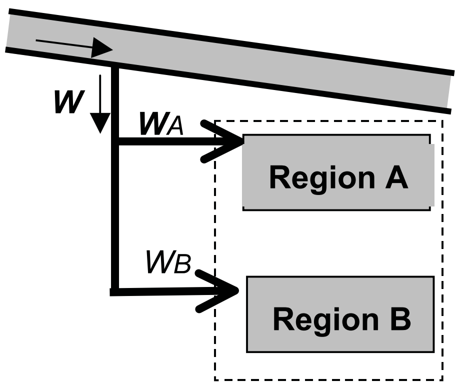


Figure 3. Water distribution model: Available water is distributed to two

regions, A and B, with the same areas of cultivated land.

If we consider a little more even water distribution, I_A will shift to the left on the horizontal axis and I_B will shift to the right by the same distance. As a result the average yield Y_{AV} increases while W (I_{AV}) stays constant. According to this process, if all available water becomes evenly distributed over Regions A and B, the water application rate for all water users is I_{AV}, which brings the average yield for the whole region to the maximum at Y_{MAX}. Now we know that an irrigation project can realize the maximum yield when the available water is distributed evenly over the service area, or beneficiary farmers.

The maximum yield is just what the government is seeking from the viewpoint of the national economy. The economic benefit happily coincides with the social need for equity. This discussion may be sufficient to show that the major target of water management should be equal water allocation, though it is abstracting some minor conditions such as the scale of the project, crop stage, soil conditions, and so on.

Two supplemental discussions should be given. First, in the discussion above the yield of Region A is reduced to get the maximum benefit of the whole region. This implies that local benefits and the national benefit conflict with each other in water management. We have to suppress the benefits of some local groups for the sake of the whole. Second, if we consider a different situation, that there is a water conveyance loss, equal water distribution will not guarantee the national maximum benefit from the economical point of view. Such a situation can easily be found during the dry season in the Asian monsoon region, especially in areas where the canals are made of earth. In this case we need to sacrifice the maximum benefit for the whole society to keep the goal of the equal water distribution over the areas. The same discussion is available for the case of poverty alleviation if the water distribution for realizing the maximum economical benefit must be changed for the poverty alleviation purpose. This means that the goals of water management to bring about economical benefit and other social benefits of equity and poverty alleviation conflict with each other. We should know that it is necessary to choose one of these goals as the priority goal in some conditions of actual water management.

5. IS FARMERS' COOPERATION POSSIBLE?

Even when a government facility is managed by the government, in correspondence with the government's goals, experience has shown that the government cannot and should not manage everything (Groenfeldt and Svendsen 2000). Governments cannot manage every facility by themselves because of budget constraints, and cannot prevent farmers from performing illegal actions on the facilities the government is trying to control. Governments need farmers to achieve the government's target. Here, we should remember that the individual farmer's target in water management is different from the government's target. If the government lets farmers manage facilities without any conditions set down or rules governing this management, the government cannot achieve its target. How can the government realize a management transfer while achieving its target?

To realize the target, farmers need to be organized and behave according to specific rules for the transferred facility. However, in the process of water allocation under limited water availability, more water to a farmer or a group of farmers means less water to others. There are strong conflicts among farmers in every region at the main, lateral, and on-farm levels (Shinzawa 1955). Therefore, we face a more fundamental question of whether or not establishing farmers' groups and gaining their cooperation are possible in principle.

The authors' idea is that despite the conflict, or rather because of it, farmers may opt to establish their own water user group and organization, because farmers can hope to realize common benefits only by establishing their own water user group to claim their right to have water. This idea has two prerequisites: First farmers need to be informed and understand the reality of conflicting structures in water management, and second, there must be an institutional system in which farmers' decisions in their group can be reflected or realized in water management at the higher canal level. If not supplied with such conditions, farmers cannot take action or formulate plans, and they then feel desperate and lose their motivation to improve their situation. Therefore, the first goal in farmer education and capacity development is to prepare such conditions and explain them to the farmers.

Based on this idea, the suggested action for governments to promote the sustainable establishment of water user groups is to prepare a table at which different water user groups can claim their rights and talk to each other, as well as a system in which whatever they decide is realized in an actual water management process.

A group of water users composed of farmers cannot operate by themselves, because if they do so, conflicts among themselves can destroy the group. A water users' group needs, for its continuous existence, a common outside interest for which they have to cooperate. Understanding the need for a common outside interest leads to a conclusion that we should not expect a successful establishment of water users' groups (WUGs) as a condition for the subsequent establishment of an integrated water users' group (IWUG) (Gautam 1997). Rather, the simultaneous establishment of WUGs and IWUG is necessary for success. This idea has been applied to JICA projects in Thailand and Egypt (Onimaru et al. 2003).

6. ROLE SHARING BY GOVERNMENT AND FARMERS IN WATER MANAGEMENT

What part of water management should farmers be involved in? As far as the scale of irrigation system is concerned, the management of a small scale irrigation project can be completely transferred to a farmer's organization. Most of the irrigation systems in Japan, even large scale ones, have been completely transferred to farmers' organizations, Land Improvement Districts (LIDs). Provided appropriate conditions are in place, a large scale project with a beneficiary area of more than 10,000 ha can be transferred to a farmer's organization such as an LID. However, a widely accepted idea for large scale irrigation systems is that governments or public sectors should manage the main parts of the systems, and the farmers' groups the on-farm facility. Japan also has examples of this demarcation, which can be called "spatial role sharing" (SRS).

However, a simple application of SRS may not be successful for PIM since many factors are involved in water management. SRS is sometimes seen as a reason for governments to no longer support or intervene with farmers' management of on-farm systems after PIM or water management transfer (WMT) has been introduced. As for the main part of the irrigation system, if every decision on water allocation is made by the government, and if these decisions are not explained, farmers won't know whether they are being treated equitably or not. Moreover, they cannot construct a farming plan if they are not informed of the water resources status of the project. Under such suspicious conditions, farmers are apt to take action for their individual benefit. Governments have no capacity to suppress such activities, which are usually committed during the night. Governments should not expect farmers to behave rationally for the national goal. It is therefore extremely important for governments, as much as is possible, to eliminate those actions which cause farmers to take selfish actions of their own, and also to prevent these actions from being taken in practice. Information dissemination and accountability are of the utmost importance.

Water management (in the broad sense) consists of operation, maintenance and management (organization and finance), among which operation can be regarded as the core of water management because it is the action that brings the water to farmers. Thus, operation may be called water management (in the narrow sense). The other two kinds of activities have rather supplemental functions that make this water management (in the narrow sense) efficient and sustainable.

An action can be divided into four processes: target setting, execution, evaluation and adjustment. The authors suggest the classification of water management (in the narrow sense) into four processes (Figure 4) to discuss the role sharing of government and farmers:

1) Decision process: Deciding on the water distribution target and plan
2) Operation process: Operating the facilities according to the plan
3) Monitoring process: Monitoring the operation to see whether it is performed as expected
4) Feedback process: Adjusting the operation or decisions based on monitoring

Each process is further explained as follows:

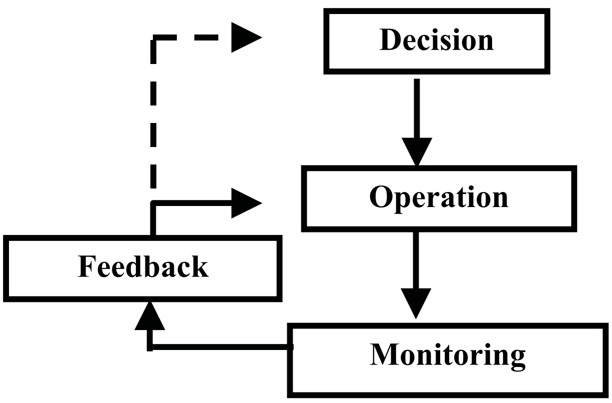


Figure 4 Four processes of water management

First, in the Decision process, how much water should be introduced and distributed to each canal must be decided based on evaluation of the water demand and supply. It makes sense for this process to be primarily covered by the farmers, because the ultimate users of water are farmers and every target is based on their request. Only farmers really understand the necessity of water, and thus they can negotiate and adjust water allocation in case a water shortage occurs. This will increase water use efficiency. However, it is the role of government engineers to give farmers the scientific and technical information on hydrology and hydraulics to enable the farmers to make rational decisions. The government should also guide and oversee the farmers' discussions so as to guard equity, which realizes the government's goal in water management. To protect the interests of everyone concerned, the decision process for the whole project should be shouldered by both the government and farmers. To make this possible, farmers should form a project level water users' organization to which every regional water user group will send delegates.

Second, government engineers should be primarily responsible for the Operation process. For, the other parties (farmers) should not be involved in operation of water distribution to keep fairness. In addition, special knowledge and skills are needed to operate the main systems. However, government officers and farmers may cooperate in the operation process at the lateral level and below.

Third, the Monitoring process includes watching for unfair or illegal operation, measuring the water delivered to each canal and ditch, and comparison of planned and actual waters as well as watching of the state of crops. Farmers should take an important role in the monitoring process, especially in watching for the illegal operation and destruction of facilities. Farmers would have a strong incentive to play a role in this process as long as they themselves have created the water distribution plan during the decision process. The results of the water distribution process should be monitored and gathered by government officials, and the information made openly available to all farmers.

Fourth, during the Feedback process, water distribution should be adjusted if there is a discrepancy between the initial plan and monitored results. To make this possible, there should be some place where farmers and government officials can get together to discuss any discrepancy. There may be cases in which the water distribution plan itself must be adjusted. Sanctions may be taken against farmers or local groups of farmers who have intentionally operated the irrigation system in an unfair way.

To realize effective water management, we should consider the role sharing of the above four functions between government and farmers for each irrigation facilities at the main, lateral and on-farm levels. This may be called "Functional role sharing" (FRS) against "Spatial role sharing". An example is seen in the Toyogawa Irrigation Project in Japan, where the water distribution plan in the whole system is decided by all organizations benefiting, although operation is the role of the public sector.

7. METHODS FOR PIM

To realize farmers' participation in water management for the whole irrigation system, a water user organization for the system needs to be formed, and must be supported by a hierarchical farmer group system such as WUG, IWUG, and so on. The challenge is how to set up and sustain such organizations.

We often see that depressed farmers in the downstream, who cannot get enough water, do not take positive action to improve their situation. Two factors may be influencing this: One is that the farmers have no expectations about the projects because they have not participated in the initiation, planning, or design. They feel no ownership of the project or irrigation canal. They just may not object to the project as long as the project has no negative impact on their traditional rain-fed farming. The second is that farmers do not understand the reason for their unfavorable situation, and cannot expect government officers to take effective action for them. This is principally because of lack of information disclosure to farmers, which is not recognized necessary by the officers.

To realize the proposed role sharing between government and farmers, the following are of special importance:

1) The government openly declares, after establishing its own goals, that beneficiary farmers have equal rights in the system, and that these equal rights are one of the principles in water management.

2) The government establishes a forum for local hydraulic groups to discuss and decide water management according to the equity principle.

Through the above mentioned roles in and the contribution to water management, farmers can have ownership in their irrigation project. The majority of beneficiary farmers would understand that equitable water distribution is necessary and can be realized by their cooperation.

We should not underestimate the importance of water distribution at an on-farm level. Inequitable water distribution at the on-farm level for a project is equivalent to inequitable water distribution on a large scale. Governments need to pay attention to this. However, it is impossible for central governments to be involved in every water management process. Local governments and communities share a common interest with the central government, that of maximum exploitation from irrigation. The central government can achieve its goal by cooperating with and supporting the local governments.

The participation of farmers in the decision making process is the issue raised in this paper that may attract the most serious discussion. There is a strong traditional attitude among government officers that they, being highly educated, should hold the power to make decisions. However, if governments do not allow farmers to participate in decision making, then they cannot expect farmers to cooperate in other aspects of the water management. As explained above, governments can achieve their goals more effectively by letting the farmers discuss decisions with them, and by sharing information with the farmers to enable these discussions to be rational.

8. CONCLUSIONS

1) We need a clear image for the practical goals and methods to realize successful participation of farmers in water management. In this regard, it should be confirmed that the first and most fundamental goal of water management for governments is to harvest the largest amount of food with the given amount of available water, and some other social goals of poverty alleviation and equitable water sharing among beneficiary farmers are accompanied.
2) Farmers have a strong incentive for irrigation management transfer (IMT), which is recommended to get higher efficiency of irrigation. However, a simple WMT to farmers with no government intervention would not realize the government goals because individual farmers have different goals.
3) The Law of Diminishing Returns shows that the equal water allocation can realize the maximum yield, which is the major target of governments in water management, under some simplified conditions.
4) Farmers have strong conflicts in water management at every level of irrigation system. However, the principal possibility of farmers' cooperation in water management can be found in these conflicts. Farmers can cooperate only to get a common benefit outside. From this understanding, a simultaneous establishment of water users' group (WUG) and integrated water users' group (IWUG) is recommended.
5) Water management (in the narrow sense) should be divided into four processes of Decision, Operation, Monitoring and Feedback. A traditional role sharing between government and farmers, in which farmers should be responsible for every function relating to the on-farm facility management, should be called "Spatial role sharing" (SRS). However, the "Functional role sharing" (FRS), in which the government and farmers should share the roles considering the function each at the main, lateral and on-farm facilities, should be introduced for the successful participation of farmers.
6) The participation of farmers in the decision process is of special importance, only

through which the government can expect farmers to cooperate in other aspects of the water management. Thus, governments can achieve their goals effectively and surely.

REFERENCES

1. Asian Development Bank: http://www.adb.org/Documents/PIDs/33453012.asp
2. Brown, L. R 1999: State of the World 1999-2000, Japanese version, pp.2006-2035, Diamond inc., Tokyo
3. FAOSTAT: http://faostat.fao.org/site/419/DesktopDefault.aspx?PageID=419
4. Fujiki, T., M. Satoh, P. Sopaphun and V. Vudhivanich 2001: Water Management Practice in Upper Chao Phraya Delta, Thailand -Analysis of water use in the Borommathad Irrigation Project-, Transactions of Irrigation, Drainage and Reclamation Engineering, 216, 1-7
5. Gautam, U. 1997: Classification on the West Gandak Experience in Nepal, INPIM, No. 6, p. 7, The World Bank
6. Groenfeldt, D., and M. Svendsen 2000: Case Studies in Participatory Irrigation Management, World Bank Institute, 157 pp., Washington, D.C.
7. Hussein, I., E. Biltonen and K. Yokoyama 2002: Identifying Pro-poor Irrigation Interventions for Irrigated Agriculture in Asia, 18^{th} Congress on Irrigation and Drainage Vol. 1A, pp. 20-23
8. INPIM: http://www.inpim.org/leftlinks/FAQ/Topic%20Page/PIM
9. Ishii, A., T. Ounvichit, Y. Ren and M. Satoh 2005: The Actual State of Farmers' Cost Sharing in Small Scale Pumping Irrigation Projects in Monsoon Asia, (in Japanese with English abstract), Transactions of Irrigation, Drainage and Reclamation Engineering, 73(4), 25-34
10. Onimaru, T., M. Satoh, K. Kawsard and K. Shioda 2003: The Present Situation and Problems of the Establishment of Water Users Organizations in the Chao Phraya Delta, Transactions of Irrigation, Drainage and Reclamation Engineering, 225, 119-126
11. Ounvichit, T., M. Satoh, S. Chantanusart and K. Yamaoka 2006: Cost sharing and sustainability of Pongsak Muang Fai irrigation system, Paddy and Water Environment, 4, pp. 81-88
12. Sato K. and M. Satoh 2006: An Organizational Structure for Effective Farmer

Participatory Irrigation Management in Irrigation Projects in Ghana (In Japanese with English abstract), Trans. of Japanese Society of Irrigation, Drainage and Reclamation Engineering, 245, 85-93

13. Shinzawa, K. 1955: Irrigation development and management in Japan, “Nogyo Suiri Ron” (in Japanese), pp. 1-10 Tokyo University Press, 449 pp., Tokyo
14. Surarerks, V. 1986: Historical Development and Management of Irrigation Systems in Northern Thailand, The Ford Foundation, 492 pp.
15. Vermillion, D. L. 1997: Impacts of irrigation management transfer: A review of the evidence. Research Report 11, 35 pp., International Irrigation Management Institute, Sri Lanka

IRRIGATION MANAGEMENT AND STATUS OF PIM ON PRODUCTIVITY IMPROVEMENT A CASE STUDY IN MAHANADI DELTA PROJECT, INDIA

DK Paul[1]

ABSTRACT

Irrigation has helped convert rainfed lands into productive cultivable tracts in India but management of water has suffered due to lack of proper operation and maintenance of the system. Even after establishment of Command Area Development Agencies (CADA, since 1974) performance of the system is still poor and resulted in half hearted adoption of Participatory Irrigation Management (PIM). The CADA Programme was taken up in Mahanadi Delta Stage-I Project, at the lower Mahanadi River Basin in 1976-77.

The CADA took up ‘On Farm Development’ (OFD) works of construction of field channels, field drains, land leveling & shaping, reclamation of waterlogged areas, enforcement of rotational system, realignment of field boundaries and consolidation of holding, supply of crop production inputs, introduction of suitable cropping pattern and services like credit, extension. The programme also covered ground water development through conjunctive use for efficient operation of the irrigation system upto the outlets.

The programme is under implementation for more than 25 years and a sum US $ 9.0 ml was spent. A study was taken up by MOWR to assess the achievements of OFD and come out with pragmatic suggestions for optimum results. The paper presents the status of PIM in the Mahanadi Delta Project with respect of the irrigation system, CAD activities, agro-climatic and socio-economic parameters, conjunctive use of water, agricultural performance, environmental impact, benefit cost ratio and recommends remedial measures.

The irrigation system comprises of 5 canals taking off from Mahanadi and Birupa Barrages covering 4 districts and 27 community blocks with a culturable command area of 1,67,000 ha (presently revised to 1,83,400 ha). A number of tributaries and drainage channels forms the drainage system (9000 sq.km) comprising of main, secondary and link drains with out fall,. A total of 44,872 ha is waterlogged of which 32,273 and 12599 ha are seasonal and perennial type with 1671 ha as marshy land. The maximum annual yield is assessed to be 89,593 MCM, with minimum and average of 1880 and 51,061 MCM. The designed average irrigation requirement is assessed to be 3315 MCM (331.5 T ham) with dependable irrigation requirement of 2527.5 MCM\ with 21.0 MCM

1- Principal Scientist (IWM), ICAR, Ministry of Agriculture, India

as the requirement for industrial and other uses. Seepage loss is assessed to be 36.3 and 22.9% in main canal and distribution system where as the field application and total conveyance losses are 15 and 59.2% respectively. The efficiency of conveyance and irrigation are 40.8 and 34.7% respectively. In pursuance to the National Water Policy (1987) the State Govt. of Orissa adopted the PIM in the “State Water Policy 1987” and provided legal back up, through Pani Panchayat Act 2002. In the beginning 4 pilot projects on PIM were launched in the first phase (1996) and later on 50 Pani Panchayats were formed and registered as legal bodies and 51% of the total irrigation potential created has been covered under PIM and handled more than 153 nos. of Pani Panchayats (WUAs). and remaining 49% would be covered by 2007.

It has humid tropical climate with good monsoon rain of 1400mm (range 902 to 2337.8 mm) The soil is moderately sandy, pH varies from slightly acidic to mildly alkaline. The infiltration rate of soil is 0.40 cm/hr in sandy soil to 0.1 cm/hr in clay loam soil. The ground water fluctuations for the entire delta in rainy season ranges between 2.18 to 3.94 m and in post monsoon from 1.11 and 2.13 m. Out of 38 blocks 12 are reported to be saline, equally shared by 3 districts of Kenderpara Jagatsinghpur and Puri. The extent of moderate and slightly saline areas are 30,291 ha. and 12,318 ha. respectively (1999-2000)

The total area of Mahanadi Delta Project covers 8304.24 sq. km. with a population of 4.8.62 million with a population density of 585 per sq.km(1991). It has 5,532 villages, 787 Gram Panchayats and 6,67,718 of house holds with per village population of around 1000 persons. Cultivators and agricultural labourers in the whole command have been estimated to be 0.551 and 0. 466 million respectively and are mostly marginal farmers followed by small, semi-medium, medium and large farmers. Average land holding ranges from 1.20 ha. to 1.41 ha.

The command area is rich in ground water with annual replenishable resource, discharge and draft of 3,70,758, 34,549 and 71,378 ha m/year respectively, with the net water availability of 3,36,209 ha.m annually. The quality of ground water is quite safe except in 4 Blocks of Kendrapara district with salinity. Till 2002, rotational water supply covered an area of 1,81,600 ha. and reclaimed waterlogging and salinity in 17,950 ha. Consolidation of holding started prior to the CADA covered 1,40,147 ha with field channels 10,7214 ha. Rs. 11.64 crores has been spent on the construction of field channels, field drains with other components like maintenance of irrigation drainage system, agricultural activities, enforcement of warabani, innovation management in irrigation with a total expenditure of about Rs. 40 crores (us $ 9 mil.).

The main crops in rainy season are paddy (91%) and in summer also paddy (41.5.%) with other major crop are pulses (27.0%), groundnut (8.5%), oilseed (0.7%), vegetables (12.5.%). 16343 multi crop demonstrations were conducted from 1977- to 2002 for improving irrigation area particularly in important crops of paddy and other high value crop like vegetables etc. Farmers have resorted to high yield varieties of paddy and other crops and have attempted to take up less water requiring crops in general. Rainy season agricultural productivity of paddy 1.6t/ha. during 1994-95 has increased to 2.5 -2.9 t/ha. in 1997-98 showing 88% increase. In summer the productivity level has gone up to 40.6 t/ha with a increasing trend of production by 55.9% from 1994-95 to 1999-2000 in both the seasons.

Since the CAD development works adoption of PIM in this command area is better as it resulted in better utilization of irrigation potential created by improving project efficiency, increasing irrigated area through available surface and ground water, bringing change in better cropping pattern and increasing agricultural production & productivity and made positive socio-economic impact in the command area of the project.

INTRODUCTION

Irrigation has helped convert rainfed lands into productive cultivable tracts in India but management of water has suffered due to lack of proper operation and maintenance of the system. Even after establishment of Command Area Development Agencies (CADA, since 1974) performance of the system is still poor and resulted in half hearted adoption of Participatory Irrigation Management (PIM). The CADA took up 'On Farm Development' (OFD) works of construction of field channels, field drains, land leveling & shaping, reclamation of waterlogged areas, enforcement of rotational system, realignment of field boundaries and consolidation of holding, supply of crop production inputs, introduction of suitable cropping pattern and services like credit, extension. The programme also covered ground water development through conjunctive use for efficient operation of the irrigation system upto the outlets.

The programme is under implementation for more than 25 years and a sum of US$ 9.0 million was spent. A study was taken up by Ministry of Water Resources, Govt. of India, to assess the achievements of OFD and progress of PIM and come out with pragmatic suggestions for optimum results in the Mahanadi Delta Stage 1 project, under the perview of the impact evaluation study through the Water and Power Consultancy Services India Ltd. (WAPCOS, New Delhi,India).

The paper presents the status of OFD and PIM in the Mahanadi Delta Project with respect of the irrigation system, CAD activities, agro-climatic and socio-economic parameters, conjunctive use of water, agricultural performance, environmental impact, benefit cost ratio and recommends remedial measures.

LOCATION AND BACKGROUND

The command of the project is located in the lower Mahanadi Basin of Orissa State in Eastern India, with its southeastern boundary touching the Bay of Bengal. The Project lies in the latitude between 190 – 40' to 200 – 35'N and longitude between 850 – 40' to 860 – 45'E. The Map-1 and Map-2 indicates it's location with reference to the country and the state.

THE RIVER MAHANADI

The river Mahanadi originates from Madhya Pradesh State and enters into Orissa in Sambalpur district and flows through the state along a distance of about 350 km. It has a total catchment of 1.3 lakh sq./km. carrying an average run off 25000 cumecs.

Its lean season flow is around 30 cumecs. The maximum annual yield is assessed to be 89,593 MCM, with minimum and average of 1880 and 51,061 MCM. The designed average irrigation requirement is assessed to be 3315 MCM (331.5 T ham) with dependable irrigation requirement of 2527.5 MCM with 21.0 MCM as the requirement for industrial and other uses. In the past years one anicut had been constructed at Jobra, Cuttack with a rainy season (Kharif) Command of about 1.5 lakh ha. The tail reach water with an average flow rate of 220 cumecs is not only used to augment the lean season (Dalua) supply into the command of the old anicut but also an additional weir has been constructed at Naraj, Cuttack for irrigating an area of about 4.3 lakh ha. The old anicut has been replaced by a modern barrage. The irrigation command of the old anicut has been named as Mahanadi Stage –1 command and irrigation command and after construction of new weir is known as Mahanadi Stage-II command projects (Fig.3)

CLIMATE

The climate of Mahanadi Delta Command Area is tropical.with good monsoon and wet climate. It is characterized by the general wetness of the air. There are 3 distinct seasons in the area. The mild winter season is from November to end of February, followed by hot summer season from March to middle of June and the third the high rainfall monsoon season from middle of June to end of October. During the monsoon season the area experiences heavy rainfall by the Southwest Monsoon with an average rainfall of 1432 cm ranging between 2688.5 mm (1995 in Puri) to 784.3 mm (in Cuttack, 1992). The mean wind velocity varies between 2.6 to 9.1 km/hr with annual average of 5.3 km/hr. The annual mean monthly relative humidity ranges between 92 % (at 8.30Hrs) to 61% (at 1730 Hrs) respectively. The Delta area is not only very close to the Bay of Bengal but also faces cyclone storms during hot summer and monsoon season.

TOPOGRAPHY AND SOIL

The Physiography of the delta presents a general topographical view of a very flat land extending over the vast plane areas with mild undulations in its micro relief. The land areas under these sub-deltas being formed by the fertile alluvium deposits carried by the two adjacent rivers are hence being named as 'doabs'. the Mahanadi Delta Irrigation Project area has been developed in two stages. The Stage-1 Project area constitutes, the anicut and gross areas under Doab-1 to IV. Similarly the Stage-II project area constitutes the area under Doab-V to VIII. The basin and catchment area relevant to the Delta command are 65,580 sq. km and 19,907 sq.km respectively

The highest land is generally located along the riverbanks, which dissect the Delta forming in to 8 doabs. These doabs tend to slope down from the river to the interior and at the coast. Slopes in the doabs interior are generally in the range of 1:5000 or 0.02%.

SOIL TYPES

Soil Survey in the Delta Command has been conducted by computerized Data Base with inputs from Satellite Remote Sensing Technology, wherein aerial photo – mosaics of 1:29,000 has been used as base map over which different land types and their area coverage information has been transferred by delineating their soil boundaries using a mirror stereoscope. Both aerial photograph and Satellite imagery has been interpreted for the entire Delta extending over 5000 sq./ km. The method adopted by National Bureau of Soil Survey involves a 3-tier approach, viz. Image interpretation, field survey, cartography and printing. As per the survey report the soils of the delta region are moderately sandy along the rivers to sandy clay loams in the low-lying areas. In general the soil texture is heavier and deeper from river edges to lower delta in the interior of the doabs and from the upper portion of the doabs starting at the delta apex to the lower area closer to sea. The soil pH varies from slightly acidic to mildly alkaline along lavies and upper regions of valley areas. Out of 38 blocks 12 are reported to be saline, equally shared by 3 districts of Kenderpara Jagatsinghpur and Puri. The extent of moderate and slightly saline areas is 30,291 ha. and 12,318 ha. respectively (1999-2000). The soil along the sea shore and adjacent low-lying areas are reported to be saline / alkaline.

THE IRRIGATION SYSTEM

THE IRRIGATION HEADWORK

The Irrigation system of the Mahanadi delta stage-I command, Cuttuck comprises of the canal network originating from Mahanadi barrage and Birupa barrage. This delta covers 21 community development (C.D) blocks of Cuttack, Jagatsinghpur, Jajpur and Kendrapada districts. The Mundoli weir is located at the apex of the Mahanadi Delta. In down stream of Mundoli weir the main Mahanadi River branches into three rivers viz., Kathjori, Mahanadi and Birupa. Correspondingly, three barrages were constructed namely, Naraj on Kathjori river at Naraj village, Mahanadi on Mahanadi river at Jobra Village, Birupa on Birupa river at Jagatpur village. These works were commenced in 1866 by British Military Engineering Services after the great Bengal famine and completed in 1883.

The irrigation system comprises of 5 canals taking off from Mahanadi and Birupa Barrages covering 4 districts and 27 community blocks with a cultivable command area of 1,67,000 ha (presently revised to 1,83,400 ha). A number of tributaries and drainage channels forms the drainage system (9000 sq.km) comprising of main, secondary and link drains with out fall,. A total of 44,872 ha is waterlogged of which 32,273 and 12599 ha are seasonal and perennial type with 1671 ha as marshy land.

Seepage loss is assessed to be 36.3 and 22.9% in main canal and distribution system where as the field application and total conveyance losses are 15 and 59.2% respectively. The efficiency of conveyance and irrigation are 40.8 and 34.7% respectively

MAIN CANALS

At the primary level the conveyance of water from the three headwork is being carried out by 6 main canal system. The canal systems coming under Delta Stage-I and Delta Stage-II are (I) Taladanda Main Canal, (ii) Machhagaon canal (iii) Kendrapara Main Canal, (iv) Pattamundai Canal and (v) High Level Canal Range and (vi) Puri Main Canal. The pattamundai canal off-takes from Kendrapara canal at R.D. 0.80 km and receives high discharge. Similarly, Machhagaon Off-takes from Taladanda Main canal at RD 11.78 kilometers and receives a discharge of 43.10 cumecs.

BRANCH CANALS

At the Secondary level there are 7 numbers of branch canals operating in Mahanadi Delta Stage-I Command. The length and design discharge of this individual canal has been given in Table 2.7. Their total length is 361.41 km at the tertiary level both conveyance and distribution of water is being manned through 431 numbers of distributors and over 531 nos. of minors and sub-minors spreading over the entire delta. The total length of these tertiary level canals is 2808.0 Km..

ENVIRONMENTAL CONDITION

CANAL DENSITY

The total length covered by the primary, secondary level canals has been calculated to be 531.71 km. It may be seen that the density of these primary and secondary levels conveyance systems is 3.2 km per 1000 ha. with a CCA. of 1,83,000 ha. After taking in to consideration of all the conveyance system and distribution system total canal length coverage is 3339.8 km. The density of canal is found to be 20.0 km per 1000 ha of the C.C.A. (Mahanadi Delta Stage I).

CONJUNCTIVE USE AND GROUND WATER STATUS

The ground water fluctuations for the entire delta in rainy season ranges between 2.18 to 3.94 m and in post monsoon from 1.11 and 2.13 m. The command area is rich in ground water with annual replenishable resource, discharge and draft of 3,70,758, 34,549 and 71,378 ham/year respectively, with the net water availability of 3,36,209 ham annually. The quality of ground water is quite safe except in 4 Blocks of Kendrapara district with moderate to slight soil salinity. It is seen that there is occurrence of sand castings in the area which are both of aeolian and fluvial origin. The sand-casting on the slip side off the meandering section of the river is of fluvial origin.

SOIL DRAINABILITY

The soil survey report conducted by National Bureau of Soil Survey and Land Use Planning Nagpur classified the soil of Mahanadi Delta in four parts:

- Soils of upland
- Soils of gently slopping coastal plains
- Soils of lower delta
- Box Sand dunes

It is revealed that in general the deltaic alluvium consists of the admixture of soils with well-drained features. Typical characteristics of soil located in micro uplands are moderate to heavy textured with poor to very poor drainage characteristics. Findings reveal the area under different soils in the delta command as given in Table 1.

Table 1: Area under Different Soils in Mahanadi Delta Stage I Project

S.N	Soil As per Morphology Classification	Delta Stage –I	
		Area in ha.	% OF G.C.A.
1.	Hydromorphic Soils	19387.50	7.32
2.	Sedentary Soils	1218.75	0.46
3.	Laterite Soil	7443.75	2.801
4.	Aeolian (Dry) Soils	4706.30	1.78
5.	Aeolian (Moist) Soils	Nil	-
6.	Saline Soils	57943.75	21.82
7.	Waterlogged Soils	2681.00	1.00
8.	Coarse Clastics Soils	26925.75	9.82
9.	Other Soils including cropland	145719.00	55.00
	Total	265000	100 %

SOIL PERMEABILITY

On an average the soil permeability in terms of its measured coefficient, hydraulic conductivity, works out to be 2.02 cm/hr for the Delta as a whole. According to USDA permeability classification the permeability of Delta is moderate in entire delta.

SOIL INFILTRATION

The soil infiltration has been observed to be 0.40 cm/hr in sandy soil to 0.15 cm/hr in clayey loam soil. It varies between 0.15 cm/hr in saturated condition sandy loam soil to 0.50 cm/hr in dry conditioned similar soil. In case of clay loam soil it varies between 0.15 cm/hr in dry condition to 0.05 cm/hr in saturated condition.

CROP PERFORMANCE

The main crops cultivated in rainy season are paddy (91%) and in summer also paddy (41.5.%). The other major crops are pulses (27.0%), groundnut (8.5%), oilseed (0.7%), vegetables (12.5.%).

A total of 16343 multi crop demonstrations were conducted from 1977-to 2002 for improving irrigation area particularly in important crops of paddy and other high value crop like vegetables etc. Farmers have resorted to high yielding (HYV) varieties of paddy and other crops and have attempted to take up less water requiring crops in general. Rainy season agricultural productivity of paddy was 1.6t/ha. during 1994-95. This has increased to 2.5 -2.9 t/ha. in 1997-98 showing about 88% increase. In summer the productivity level has gone up to 40.6 t/ha (1999-2000) with a increasing trend of production by 55.9% from 1994-95.

RESULTS AND DISCUSSION

IMPLEMENTATION OF NATIONAL WATER POLICY

Ministry of Water Resource, Government of India, has given a high priority for farmers' participation in irrigation water management in its National Water Policy (1987). The policy that recognizes the importance of Participation of Farmers and Voluntary Agencies stressed that efforts should be made to involve farmers progressively in various aspects of management of irrigation systems, particularly in water distribution and collection of water rates. Assistance of voluntary agencies should be enlisted in educating the farmers in efficient water use and water management. As per the Ministry of Water Resources New Delhi, a number of actions have been taken in the Mahanadi Delta Stage –1, namely, preparation and circulation of guidelines for making legal provisions in the Orissa State Irrigation Acts, through modifications providing technical and financial help. Holding of seminars, workshops to create awareness among the officials/officers and farmers etc. This has brought a catalytic effect on PIM activity in many states including Orissa.

CAD PROGRAMME IN ORISSA STATE

The CAD programme was taken up in Orissa in 1974-75 for ushering in Participatory Irrigation Management (PIM) itself by inclusion of four of the major irrigation projects, namely Hirakud, Salandi, Mahanadi Delta Stage I (Cuttack) and Mahanadi Delta Stage II (Puri). After experiencing usefulness of the programme, nine more irrigation projects were also included in different years till 1998-99 and some others later on. Six CAD Authorities were constituted under the Societies Registration Act, 1860, as applicable to the State of Orissa to supervise the CAD work in 7.12 lakh ha. of cultivable command area (CCA) representing 10.9 lakh ha gross command area (GCA)

PIM APPROACH AND FARMER'S PARTICIPATION IN IRRIGATION MANAGEMENT

In pursuance to the National Water Policy (1987) the State Government has adopted the PIM policy in the Orissa State Water Policy 1987 with an objective to transform the irrigation management to such farmers. Similarly, the state government has introduced the Pani Panchayat Act 2002 with an objective to give legal states to such farmers' organization for appropriate handling of the operation and maintenance (O&M) affairs of the land systems at the tertiary level. The state government action was based on two important activities i.e. Farmers Organisation and Turnover (FOT) and Participatory Irrigation Management (PIM).

INSTITUTIONALIZATION OF PIM PROGRAMME

The Command Area Development Authority Mahanadi Delta Stage-I, Cuttack was constituted in pursuance of resolution Dated 12th May 1976 of erstwhile Agriculture & Cooperation department as a legal body and was registered as a society under the Societies Registration Act 1860 in the year 1976-77, comprising 21 Community Development blocks. The Command Area Development Authority aims at effective utilization of irrigation potential through execution of different works like, On-Farm Development Works, Rotational Water Supply, Warabandi, Training of Farmers, Multi Crop Demonstration Programme, Topographical Survey etc. For providing irrigation network unto the farmer's field to increase agricultural production and productivity in the field, tangible improvement in the standard of living of the farmers of the command area is the cherished goal of the authority.

FEATURES OF WATER USERS ASSOCIATIONS (PANI PANCHAYATS)

The PIM component attached to the FOT component mainly governs irrigation management at the territory level of the irrigation system i.e. particularly at distributory/Minor/Sub-Minor level.

It envisages the following powers and responsibilities:

i. It gives a legal right to participate in operation, maintenance and management of irrigation system leading to farmer's empowerment.

ii. It gives the freedom and flexibility in choice of crops and land use within the stipulated quota of water allocated as per agreement.

iii. It assigns equability in getting irrigation water as per agreement on a long term basis from the irrigation agency.

iv. It enables taking joint discussion in irrigation planning design and construction at the micro level.

v. It gives a broad scope to achieve more irrigation coverage through optimum, water use and thereby to reduce the water fees per ha.

Till 2002, rotational water supply covered an area of 1,81,600 ha. and reclaimed waterlogging and salinity in 17,950 ha. Consolidation of holding started prior to the CADA activities and covered 1,40,147 ha with field channels in 10,7214 ha.. Rupees 11.64 crores (US$ 2.9 mil.) has been spent on the construction of field channels, field drains with other components like maintenance of irrigation/drainage system, agricultural activities, enforcement of warabandi, innovative management in irrigation with a total expenditure of about Rs. 40 crores (US$ 9 million).

IMPROVEMENT IN DEMAND AND SUPPLY OF WATER

The demand and supply of Mahanadi Delta as a whole has been assessed. A broad picture has been assessed as indicated below

Table. 2: Irrigation requirement and water supply figures over the years 1984-2002

i)	Irrigation Requirement as was initially designed	331.5 Thousand ham (Tham)
ii)	Average water supply for irrigation made during 1984-86	240.075 Tham
iii)	Irrigation Supply made in subsequent year	381.87 Tham
iv)	Present Water Requirement	
	a) for Irrigation	481.10 Tham
	b) for Industrial etc. uses	21.0 Tham

From the above, it is observed that percentage requirement, has been increased to about 50% for irrigation and industrial uses. Efforts are being made to prepare the water supply through modernization and proper maintenance of irrigation system and proper management of irrigation water.

IMPROVEMENT IN IRRIGATION POTENTIAL UTILISATION

The cultivable Command Area, of Mahanadi Delta Stage-I is 1,83,000 considering, 163% irrigation intensity, the ultimate irrigation potential has been assessed as 300,100 ha. The irrigation potential created and utilized in the project so far is given in **Table 3.**

Table 3: Detail showing periodical Irrigation Potential Utilisation in Mahanadi Delta Stage I Orrisa.

S.N.	Period	Irrigation Potential Utilisation				Remarks
		Kharif	Rabi	Rabi (ha.)	% increase over 1976-77	
1.	1976=77	157917	69875	227792	-	Maximum utilisation of irrigation potential utilization in 1989-90
2.	1979-80	167402	89859	257261	12.9	-do-
3.	1984-85	167594	116241	283835	24.6	-do-
4.	1989-90	198633	135335	333968	46.6	-do-
5.	1994-95	184207	69314	253521	11.3	-do-
6.	1996-97	139327	92486	231813	1.8	-do-
7.	1999-2000	139327	63000	202327	-3.0	-do-
8.	2001-02	139327	63000	202327	-3.0	-do-

The Mahanadi Delta Stage-I is more than a century old project and water is available from run-off of the river through different barrages. There has been considerable improvement in the irrigation potential utilization after the implementation of the PIM/CAD programme (however fluctuation in potential utilisation has been observed in different years due to varying rainfall pattern).

In the inception year the utilization of irrigation potential was in 227,792 ha. which has increased to 257261 ha in 1979-80 i.e. 12.9 percent increase over 1976-77. 2,02,327 ha during 1999-2000 and 1,39,327 ha. during 2001-02 etc. However, the irrigation potential was less in many years due to scanty rainfall, pattern. So far as designed and planned CCA re concerned, it was 1,67,000 ha. and 1,83,400 ha. respectively. However 190% irrigation intensity is expected by the State on the completion of CAD works as against 167% now.

TRAINING OF FARMERS

To educate the farmers in modern scientific technology for proper utilization of irrigation facilities as available in individual farmers' fields this component was brought to change the traditional mind set of the farmers and modernizes their outlook and approach. After completion of OFD works regular one day duration training camps have been/are being organised under the CADA Blocks usually in villages selected for warabandi and demonstration programme in both kharif and rabi season. The year wise organization of farmers training programme and number of farmers trained are given in **Table 4**.

Table 4: Year Wise Organisation of Farmers Training Conducted Under Mahanadi Delta Stage I Project, Orissa From 1980 to 2002

Year	Achievement			
	Delta stage -1		Delta stage -2	
	No. of Training Camps Organised	No. of Farmers trained	Nos. of Training Programme Organised	No.of Farmers Trained
6th Plan 1980-85	227	9850	2	132
7th Plan 1985-90	120	8116	35	1920-
8th Plan 1992-97	-	-	235	23677
9th Plan 1997-2002	362		172	17400
Upto 9th Plan, 2002	982		493	46969

BENEFIT COST RATIO

FINANCIAL ACHIEVEMENT/PROGRESS

For success of PIM the CAD programme is carried out for On-Farm Development works like construction of field channels, field drains, reclamation of waterlogged areas and other related activities like soil survey, topographical survey, land leveling and shaping etc. As per the assessment of the State Government the ratio between capital cost and other activities works out to around 55% and 45%. Thus the cost on OFD works is assessed at Rs.1162.00 lakh and Rs. 971.221 lakh on other items. This expenditure is used for calculation of B: C Ratio as follows:

Net income from agricultural produce and benefit cost ratio	(Rs. in Crores)
i) Net benefit at post CAD project stage (1999-2000)	224.20
ii) Net gain at pre CAD project i.e. at inception stage (-)	154.99
iii) Net income in one-year (a)-(b)	69.21

Total expenditure / investment made on the cad programme in the project of from inception to 1999-2000.

a) Total Expenditure	39.64
b) Expenditure on capital items	11.64
c) Expenditure on other items	28.00
d) Expenditure for calculations of B: C RATIO	
i) 10 % interest pn capital expenditure	(+) 1.16
ii) 2.5 % interest for maintenance	(+) 0.29
iii) 1% for depreciation	(+) 0.12

Total	1.57
iv) Expenditure are other items	(+) 28.00
v) Total expenditure	29.57

$$\textbf{Benefit: Cost Ratio} = \frac{\textbf{Net Gain (net gain in one year)}}{\textbf{Total Expenditure}}$$

$$= \frac{\mathbf{69.21}}{\mathbf{29.57}} = \mathbf{2.34}$$

CONCLUSION

Orissa stands out as a under-developed State within the Indian dominion even though it has been endowed with rich natural and mineral resources. The estimate Water Resources of the state is one of the highest in the country, being of the order of 11%

with 4% geographical area. The State is made up of small and marginal farmers, thus the strategy in planning and managing water resources assumes greater importance.

The first step made in this process of reformation was to hand over a part of the network of the canal system/irrigation system for its operation and maintenance (O&M) to the farmers or the beneficiaries through the Pani Panchayats (Water User Associations or WUAs). Four Pilot projects in the first phase namely, Ghodahad project, Rushikulya Distributary No.11 of Ganjam District and Aunli and Derjang Projects in Anugul District were identified for this work during 1996 and related activities of Pani Panchayat (WUAs) started simultaneously in the projects. The farmers were demonstrated about the utility and practicability of Pani Panchayat. Soon after inception, 50 Pani Panchayats were formed in these projects with the help of NGOs and WALMI. Farmers were advised to take up minimum maintenance work by them for ensuring free flow of water up to the tail reaches. They were also helped to organize water distribution in their jurisdiction, resolve disputes, if any, and adopt their own crop-planning etc. The Pani Panchayats were registered as legal bodies to provide the required identify. In pursuance to the National Water Policy (1987) the State Govt. of Orissa adopted the PIM in the "State Water Policy 1987" and provided legal back up, through Pani Panchayat Act 2002. In the beginning 4 pilot projects on PIM were launched in the first phase (1996) and later on 50 Pani Panchayats were formed and registered as legal bodies and 51% of the total irrigation potential created has been covered under PIM and handled more than 153 nos. of Pani Panchayats (WUAs). and remaining 49% would be covered by 2007.

Since the CAD development works, the adoption of PIM in this command area is better than many other Command Area Development Programmes in the country. It resulted in better utilization of irrigation potential created by improving project efficiency, increasing irrigated area through conjunctive use of available surface and ground water, bringing changes in better cropping pattern and increasing agricultural production & productivity. It has made positive socio-economic impact in the command area of the project.

IMPLEMENTED PROCESSES OF THE SMALL IRRIGATION DEVELOPMENT PROGRAMME IN BURKINA FASO

Athanase Ouedraogo[1]

ABSTRACT

The total irrigated area in Burkina faso is about 233,000 hectares, some over 70% of which are in the West South West and East Centre regions and about 4% in the Sahel region. The country is tropical and monsoonal with annual rainfall varying from 200 mm to 1000 mm depending on localities. Till now the principle irrigated crop has been paddy and irrigation has been needed in the wet season to provide water during dry spells.

Despite the good macroeconomic performance obtained through the adoption and the implementation of stabilizing programmes and structural reforms in order to improve the management of public finance and to liberalize the economy sector, living conditions of the population have not been significantly improved and Burkina faso is still facing the challenge of poverty with over 46% of the population living below the poverty line.

As population and food requirements are increasing, on the basis of the guidelines of the Poverty reduction Strategic Plan (PRSP), the government decided to significantly promote the development of the small-scale village irrigation as part oft the strategic policy actions of the Rural Development Strategy. In this context, a small-scale village irrigation development pilot program which aims primarily at achieving self-sufficiency in food has been implemented.

Relying on farmer's participatory, on the whole, the small-scale irrigation has yielded benefits. They include use of irrigation in the dry season as well as in the wet season to provide water during dry spells for food crops (maize and beans) production, reduced immigration of young rural population during the dry season and increased agricultural activities. Yields per hectare have increased in areas where dependable water is available. There have been increases in cropping intensities, which have increased agricultural activities and stimulated a rise in local business activity. Finally the implementation of the small-scale irrigation pilot actions helped to attain self-sufficiency in cereals in Burkina faso for two years. While substantial benefits have been obtained from the small – scales village irrigation development pilot program,

1- Head of Department of irrigated farming development, Ministry of Agriculture, Hydraulics and Fish Stock / Small Irrigation Development Program, Tel: 0022650361610, Fax: 0022650369747,
E-mail: athanaseouedraogo@hotmail.com

much remains to be realized: in most regions the benefits have not yet reached all the part of the population that lives under the threshold of extreme poverty estimated at 27.8%. Constraints include:

- Lack of water availability and formal land tenure system, which has delayed the motivation and restricted irrigation activities;
- Difficulties in implementing a cropping calendar that optimize water use, largely due to delays and uncertainties in the supply of agricultural inputs, and lack of commercialization possibilities and structures
- Lack of training of irrigation operational personnel and producers on irrigated areas choosing;
- Lack of communication between farmers and irrigation operational personnel and organization of producers.

Experience shows that farmer's participation is a key factor in the successful development of irrigation. However, methods, procedures and policies to motivate and train farmers for effective participation are still in an early phase of development. Pilot actions and measures to test appropriate concepts and methods are being conducted.

Early results point to the importance of strong government support for participatory approaches, training at all level, new attitudes of irrigation personnel, new procedures and methods to assist farmers in funding, commercialization of the produced cash crops and capacity building in promoting of the local industries and traders to respond to farmer's needs.

Key words: small-scale irrigation scheme, cropping calendar, farmers' participatory, self-sufficiency in food, rural development strategy, multi criteria analysis and responsabilisation.

I. BACKGROUND INFORMATION

1.1. CONCEPT OF THE SMALL-SCALE IRRIGATION DEVELOPMENT

The most commonly used irrigation method is surface irrigation. The schemes obtain water from rivers or reservoirs and use gravity-fed canal systems. Where gravity flow is not possible, water is lifted by pumps. Overhead irrigation (sprinkler and drip irrigation) is used for large-scale sugarcane production.

According to scheme size, degree of water control, level of technology or type of management, Africa's irrigation types and practices can be classified in various ways.

If the scheme size is taken as the basis for classification, four main categories can be distinguished:

- very large-scale schemes: typically over 10.000 ha with full water control and under government management. Examples are the gravity schemes in the large river basins in Sudan (Gezira), Morocco (Gharb) and Egypt;
- large-scale schemes: typically 1.000 to 10.000 ha with full water control. Generaly under government or commercial management, the latter usually less

than 5.000 ha. Examples are found in Kenya (bura; Mwea), Tanzania (Mabarali), Somala (Shebelli);

- medium-scale schemes: typically 100 to 1.000 ha with full or partial water control. Government managed, government assisted cooperatives, or commercial estates;
- small-scale schemes: typically 1 to 100 ha, controlled by farmers' groups, or single farmers.

If the level of technology or the type of management is taken as the basis for classification, the terms "formal" and "traditional" (informal) irrigation could be used. Formal irrigation schemes are usually developed and managed by a government institution on behalf of the smallholders or labourers. Formal irrigation projects are typically medium, large or very large-scale developments. In contrast, traditional irrigation is usually small –scale. It refers primarily to schemes which are under local responsibility, controlled and operated by the community in response to their felt needs. The main traditional irrigation developments include the following:

- small –scale developments using manual or animal power or small pumps to obtain water from dug wells or ponds;
- small temporary river diversions or development of swamps;
- water spreading or harvesting: simple bundings collecting runoff water or flash floods discharging onto flat land.

Small- scale developments often have only partial water control and use traditional methods of water application and local materials. The works may be temporary and may need to be rebuilt annually. In some cases, natural flooding, if it implies some form of control of water, is grouped under the heading of traditional irrigation.

According to government policies on scheme operation and maintenance, irrigation systems varied widely from country to country. In Thailand, government efforts have transformed almost all the irrigation systems into government scheme (constructed and management by the government) which are usually large and medium scale projects built for increasing rice production to stabilize the domestic price of paddy and to enable this country to maintain its rice export position and people's scheme (constructed and managed by farmer with the assistance of the government) which are mostly small-scale and are rehabilitated or improved by the government to assist small farmers.

In Philippines, according to ownership, irrigation systems are classified into national, communal or private. National irrigation systems are owned, constructed and managed by the government. Communal irrigation systems are owned and managed by farmer's irrigation associations. Private systems are those constructed and managed by an individual to irrigate his land and sometimes that of a few neighbours. This kind of irrigation systems may be classified into small-scale scheme.

Irrigation systems in Indonesia may be classified into four general categories: technical, semi-technical, simple and village. The first three are constructed and managed by the government, while the fourth (village irrigation) is constructed and managed by farmer's groups. Simple are those that don't exceed 2,000 hectares selected by the government according to standard criteria generally without an economic feasibility study. Designs are simple so they may be easily constructed using labour intensive methods. Technical and semi-technical systems are larger systems subjected to more rigorous feasibility studies and technical requirements. In all the systems constructed by the government the general policy is to construct only the main system and leave the farm level system as responsibility of the farmers.

Compared to the other three countries, small–scale irrigation development scheme in the new Rural Development Strategy in Burkina Faso has the smallest irrigated areas: typically about 0.1 to 20 hectares, controlled by farmers' groups, or single farmers, with only partial water control and use traditional methods of water application, new cropping techniques, and improved technologies and local materials. The works may be temporary and may need to be rebuilt annually. Examples are: Kenya, Zimbabwe, Tanzania, Madagascar for simple river diversions, Nigeria (fadama) for shallow groundwater, and Kenya, Tanzania for pumping from lakes. At present, the small–scale irrigation development scheme includes irrigated areas, which are over 50 hectares constructed with technical and economic feasibility studies.

1.2. FARMER'S PARTICIPATION APPROACH

1.2.1. Multi criteria analysis for determining the strategy

In order to take into account the diverse flaws, notably those related to passed experiences in the implementation of similar programmes, the execution of the pilot actions to test appropriate concepts and methods for farmer's participation relied on responsabilization of them and the reorganization of agricultural regions into three appropriate production areas.

The responsabilization of the producers include use, increase and creation of conditions favourable to the building of irrigation farmers' autonomy groups or agencies, which are able to respond to their needs, increase the responsibility of populations in the infrastructures management, develop economic market and improve women's economic status in rural area at farm level. The strategic main criteria, which are needed relied on leadership of heads of farmer's groups, their capacity for working together, the group's capacity to resolve internal conflict, the motivation of all the members and their creativity and dynamism.

The reorganization of agricultural regions into three appropriate produced areas relates to their classification into three regions according to specific characters relates to their physical potentialities (water and irrigated areas availability), increase of human resources (organisational and technical capacities of farmer's group or single farmers), Yields per hectare, the increase in cropping intensities and irrigated areas. This classification aims primarily at improving, conjointly with farmer's groups or single farmers, appropriate cropping and production systems and cropping calendar for optimizing water use and increasing the cropping intensity of the systems. The choose of crops is done together by farmers and government regional structures, which are charged to improve irrigation at farm level.

1.2.2. Implemented actions and measures

1.2.2.1. Identification and choice of the sites of production

For each proposed irrigation site, this process has taken three months including two weeks reserved for approval by the administration. The identification and choose of the sites relied on possibilities of precision of the physical and socio-economic framework of the site development, the elaboration of a site development plan and the working out of the technical basic data which can be used for the elaboration of the detailed development draft project.

For the final choice, in all the irrigation sites, one of the most important criteria used conjointly by farmers and irrigation operational personnel concerned the motivation of the beneficiaries groups in promoting the development of farmer organisations and co-operative structures responsible for the irrigated areas exploitation and engaged for the introduction and popularization of new cropping systems and techniques and approaches in order to increase their fully access to bank funding and supplies in inputs. In addition, farmers fully implication in appropriation of the realised actions and measures to allow the development of small-scale irrigation scheme is higher appreciate. Usually, employed methods for identification and choice of each proposed irrigation site relies on participatory approaches such as semi-structured interview and accelerated researches methods for participation.

1.2.2.2. Establishing of development scheme

The established development scheme has taken into account the findings of the particular studies formerly undertaken (topography, pedology, socio-economy, etc.). Because of its cost, in the whole, the established development scheme is implemented only for the irrigation sites, which are over 20 hectares and includes the presentation, description, calculation of the ideal dimensions, the execution method and the cost estimates of the irrigation works and of other needed infrastructures (social, communications) as well as the corresponding works. It also includes the land tenure system management and the description of the agricultural development actions, in terms of optimum choice of speculation and of organization, of maintenance actions and of needed means to this effect, as well as the supportive measures at the social and environmental level.

According to the conceivable development options, the development scheme is presented in a certain number of alternatives. For each of the alternatives, the phases of the execution is described in an argued manner and the costs and advantages is assessed at the economic, financial, social and environmental levels. The cost estimate is related to all the investments (hydro-agricultural and supportive infrastructures) and all the operation and production expenses. This kind of irrigation sites are constructed by the government the general policy is to construct only the main system and leave the farm level system as responsibility of the farmers.

Irrigation sites, which are less large than 20 hectares are constructed and managed by farmer's groups or individual farmers without a feasibility study. In some cases, those that exceed 10 hectares are constructed with simple designs and managed by the government.

1.2.2.3. Information, sensibilisation and organisation of producers

Because of the climatic hazards particularly in the East, North and Sahel regions and the repeated droughts over the latest decades in Burkina Faso, it is clear that the actions aiming at monitoring water through irrigation are still to play an essential role in the development of agricultural production and the strengthening of food security. All of information, sensibilisation of producers actions aimed at showing that the small-scale irrigation development is today an important alternative to solving the hunger and poverty issues in our country.

The actions which aimed at achieving farmers' groups and organisations building relies on the Law n° 014/96/ADP of 26th May 1996 relating to agrarian and land re-organisation. For their implementation, the following ministries which act through their decentralized structures and specialized organisations and institutions are concerned:

- the Ministry of Agriculture, Hydraulics and Fish Stock (MAHRH) which supervises the essential part of the activities relating to plant fish production,
- the Ministry of Animal Resources (MRA) which supervises the activities related to animal production
- the Ministry of Environment and Life Framework which covers all the activities related to environmental, forest and fauna issues
- the Ministry of Secondary, Higher Education and Scientific Research (MESSRS) in charge of agronomic and environmental research.

These ministries are represented in the country by regional and provincial directorates.

In order to fulfil their mission, the ministries rely on specialized organizations, namely:

- the National Institute of Environment and Agricultural Researches (INERA) in charge of agronomic research, including breeding
- the Water and Rural Equipment Fund (FEER), a public establishment oriented towards the management and coordination of the funds destined to development activities of land and water resources and equipment of rural world ;
- the Agricultural and Commercial Bank of Burkina (BACB) and the Union of Poplar's Banks of Burkina (URCP-B), which are limited companies in charge of granting agricultural credits,
- the National Office for Soils (BUNASOLS) in charge of soil analysis,
- the National Council for Environment Management (CONAGESE) in charge of the management of environment,
- the Professional Agricultural Organizations (OPA) for the organization and operation the rural environment,
- the Decentralized Financial Systems (SFD) that are the savings and credit institutions, etc.;

These different organizations and administrative services have enough qualifications, great experience as well as acknowledged and valued competence. They have implemented diverse approaches relating to village lands, water resources sustainable management, improvement of the women's economic status in rural area, participation responsabilisation of beneficiary populations in the infrastructures management and the approach of local development at the farm level, which are undertaken in order to underscore the strengths and weaknesses of anterior experiences.

1.2.2.3. Definition of expected outcomes per year

The main results aimed at by the programme are:

- an increase in the maize and beans production by 3 400 tonnes per year
- modernization of agriculture through the adoption of simple, appropriate and law cost technologies,
- popularization of the research findings

The prevision of number and areas of developed irrigation sites relies on results of the selection of farmer's micro-projects and previous irrigation sites of production of each region.

1.2.2.4. Farmers and irrigation operational personnel training

Since several years, Burkina Faso's agriculture is subjected to more and more frequent and severe climatic hazards (difficult starting of rains, bad distribution in time and space, drought pockets, floods, rains early stop, ...). Face to this situation, water and irrigation techniques control reveals an essential condition to securing and diversification of agricultural production. From this diagnostic, it appeared opportune to implement, at the local and national level, strategic training programmes allowing to success. In this way, training programmes on soil water relationships, water requirements, water allocation and scheduling and maintenance procedures, irrigation sites identification and choice, micro-finance management, foot and motor pumps maintenance and reparation and soil's fertility management. Journeys of demonstrations of obtained results, commented visits and travel's studies are revealed necessary in some cases to increase farmer's technical and organisational capacities building.

1.2.2.5. Small-scale irrigation scheme funding

Irrigation development in Burkina Faso aims primarily at achieving food self sufficiency. To reach this objective, namely through the small-scale village irrigation development, the improvement of the women's economic status and the development of market economy in rural area, financing actions of irrigation construction are arranged through a mix of foreign loans and domestic funds. The implementation is undertaken together by the small-scale village irrigation development programme with its regional coordinating committees, the Agricultural and Commercial Bank of Burkina (BACB) and the Union of Poplar's Banks of Burkina (URCP-B), which are limited companies in charge of granting agricultural credits. NGOs and other government agencies with the participation of beneficiary populations provide assistance through coordinating committees.

All these funding institutions have been established at both national and local levels for the purpose of preparing production plans and targets and coordinating the supply of irrigation water, credit fertilizer, seeds, ago-chemicals and agricultural extension services. Through the elaboration and submission of their micro-projects to the required funding institutions, farms participate in the planning and implementing of irrigation projects.

1.2.2.6. Realisation of works relating to the sites

For the small – scale irrigation sites which are over 20 hectares, the execution of the works begun with the approval of the feasibility studies reports and the choice of the companies.

Monitoring of works is realized by a research consultancy recruited to this effect and different from the one conducting the execution studies. The works are realized in accordance with the companies' consultation file.

For the others, this phase relies on construction of simple bundings collecting runoff water or flash floods discharging into flat land by farmer's groups or individual farmers under the technical supervision of agricultural extension operational personnel. On the whole, it begins with the provision of agricultural inputs (credit fertilizer, seeds, ago-chemicals and irrigation materials).

1.2.2.7. Development and farmers' technical supervision in the sites

This phase includes:

- distribution of plots of land
- setting up of a producers organization
- producers training,
- exploitation of plots of land by producers,
- technical supervision of the producers during the production campaign.

II BENEFITS OF SMALL – SCALE IRRIGATION DEVELOPMENT PILOT ACTIONS

Through the small-scale village irrigation pilot actions, the main objectives relate to achieving food self sufficiency. After the implementation phase, many benefits have been obtained and additional activities have generated. They include:

- use of irrigation in the dry season as well as in the wet season to provide water during dry spells for food crops (maize and beans) production and increase of yields per hectare in areas where dependable water is available. Before implementing of small-scale irrigation pilot actions the maize and beans lands were productive only during the wet season, averaging only 1.0 tons to 1.5 tons per hectare in one year for maize and 0.6 tons to 0.8 tons per hectare in one year for beans. With the introduction of dependable small-scale irrigation water supplies, the risks of agricultural production have been considerably reduced and farmers, with help of funding institutions, began to invest in fertilizers, high yielding seeds, agrochemicals and improved cultivation practices. Yields increased from 3.5 tons to 7.0 tons per hectare twice a year, especially in the systems served by storage reservoirs for maize and 0.9 tons to 1.5 tons per hectares twice a year for beans;

- reduced immigration of young rural population during the dry season through the increase of the agricultural activities. About over 0.4% young rural peoples which were previously immigrants, have been participated to the promotion of dry season production activities, namely through the adoption of simple, appropriate and law cost technologies for implementing of small-scale irrigation development activities;
- increase in cropping intensities especially in the systems served by storage reservoirs;
- stimulation of a rise in local business activity. Through the works, development and transformation and commercialisation phases, the implementation of small-scales irrigation actions which have not yet reached a stage of full maturity, and much remains to be achieved, their beneficial impact, on the whole, has yielded increased employment and business activity in the rural areas;
- increase in providing services to farmers. The high agricultural activity generated increased services to the farmers. Banks providing credit to the farmers expanded their operations. Both government and private agencies, dealing with fertilizers, agrochemicals and high yielding seeds had to handle more business and employ more people.
- additional incomes for many farmers through duck raising near irrigation canals and the commercialisation of production in the dry season;
- contribution to the self-sufficiency in cereals. The increased maize production, the principal staple, made Burkina faso self-sufficient in cereals or reduced the impacts of lack of food production during the drought and other risks of agricultural production, despite the yearly increases in population.

While substantial benefits have been obtained from the small – scales village irrigation development pilot program, much remains to be realized: in most regions the benefits have not yet reached all the part of the population that lives under the threshold of extreme poverty estimated at 27.8%.

Constraints include:

- Lack of water availability and formal land tenure system, which has delayed the motivation and restricted irrigation activities;
- Difficulties in implementing a cropping calendar that optimize water use, largely due to delays and uncertainties in the supply of agricultural inputs, and poor or lack of shops for the manufacture of small farm machinery and activities in the storage, milling, transportation and marketing of cereals;
- Lack of training of irrigation operational personnel and producers on irrigated areas choosing;

- Lack of communication between farmers and irrigation operational personnel and organization of producers.

III. EXPERIENCES GAINED

The Burkinabè economy rests mainly on the sectors of agriculture and rearing which provide in average 40%(25% agriculture, 12% rearing and 3% forestry, fishing) of the Gross Domestic Product and ensure 80% of the overall exports by themselves. The economically working part of the population is employed at 86% in agriculture and rearing, 5.8% in agricultural activities, 4% in industry and urban handicraft and 4.2% in services. Despite important economic progress, the rural population remains extremely poor. The proportion of poor represents 45.3% of the total population. The part of the population that lives under the threshold of extreme poverty is estimated at 27.8%. Irrigation practice being relatively recent in Burkina Faso, the irrigation systems have begun to develop but from 1960s. The total developed areas, all kinds merged, are estimated at 24,161ha.

The urge to improve the village small-scale irrigation development process yielded noticeable benefits which permitted the agricultural sector to fully play continuously its role of driving force of the economy. But more often there were obvious constraints to better small - scale irrigation performance, which may be broadly grouped into:

- Constraints in planning and construction of irrigation systems. They include difficulties in promoting the development of farmer organisations and co-operative structures responsible for the irrigated areas exploitation, introduction and popularization of new cropping systems and techniques and access to bank funding, supply in inputs and the relatively high cost of irrigated areas developments
- Constraints in improving performance of existing irrigation systems, which are related to degradation of natural resources namely the lowering of soil fertility, problems of selling of products on local and external markets, ownership security and socio-cultural heaviness tending to marginalize the young peoples, particularly women in the rural society and the level of farmers' instruction compared to the management of infrastructures, the management of water, the functioning of the co-operative.

From the assets found in small-scale irrigation with the pilot tests which have produced significant results these last years, improvement of performance of existing systems is considered judicious since many irrigation systems are performing well below their potential. In more often cases, it consists to increase cropping intensity in irrigated areas. However, limiting this measure to this activity only is unlikely to obtain a noticeable impact. It appeared opportune to define, at national level, institutional policies and management practices allowing to exploiting carefully the water resources.

3.1. ROLE OF GOVERNMENT

Irrigation development in Burkina faso aims primarily at achieving food self sufficiency. Initially there was a preference for large projects because of greater visibility, perceived economies of scale, and expected greater impact on production and overall benefits. Lately, however, there has been a shift in programmes to small scale projects in order to use irrigation in the dry season as well as in the wet season to provide water during dry spells for food and cash crops, as these latter require less funding and can generate benefits in a shorter time.

Through its coordinating committees, government agencies provide with the participation of beneficiary populations financing assistance in construction, supply agricultural inputs and agricultural extension. The implementation is undertaken together by the small-scale village irrigation development programme with its regional coordinating committees, the Agricultural and Commercial Bank of Burkina (BACB) and the Union of Poplar's Banks of Burkina (URCP-B), which are limited companies in charge of granting agricultural credits, NGOs and other government agencies. More often, government irrigation agencies have programmes to organize water users groups by turnouts to enable farmers to carry out their responsibilities at the farmer level. But in more cases these programmes have not yielded benefits.

3.2. FARMERS' PARTICIPATION

Because it is a key factor in the successful development irrigation, during planning and construction, participation of the farmers is required in location of canals and structures or construction of simple bundings collecting runoff water or flash floods discharging into flat land under the supervision of agricultural extension. For each irrigated sites, implemented actions to obtain participation of the water users furthers is usually included their choice according to their requests of capability building of their irrigation associations. Consequently, their increased participation has limited wastage of water at the farm level, facilitated equitable water distribution, mobilization of labour or constitution of funds for the credit's counterparts or the maintenance of canals and pumps that cannot be undertaken by the government due to lack of funds, agricultural practise, agreed irrigation schedules, and a feedback of field problems to the agricultural extension agencies operating the system.

Where successful methods, practices and actions to maximize farmers' participation in information, sensibilisation, planning, construction and operation and maintenance of irrigation systems have not been implemented, motivating of farmers is delayed and training for their effective participation in irrigation development and management poses legitimacy problems to the irrigation agricultural extension agencies, which do not understand or consent the idea and concept of farmers' participation.

Improvement of farmers' participation does not need bureaucracy. It requires pluridiciplinary unrest working with farmers.

3.3. SMALL-SCALE IRRIGATION SCHEME FUNDING

The funding institutions of **small-scale irrigation scheme are** Kuwait Fund for Arab Economic Development and the government of Burkina Faso. As the majors irrigation projects which are funded by loans from foreign financing institutions and local counterpart funds, the main problem registered relate to lack of domestic funds for constructing or rehabilitation irrigation systems. The counterpart funds are voted only for the personnel expenses.

In addition, in more irrigation sites which are less than 20 hectares operated by farmers' groups, the lack of funds and resources for suitable operation and maintenance of the irrigation systems poses a basic constraint to better irrigation performance, because of its combination with other problems such as the poor mobilizing contribution in cash and labour from association members, their low capacity to manage the system effectively for equitable water distribution, conflict resolution and system maintenance. In those which are over 20 hectares, generally, this lack is combined namely to the low paying capacity of farmers due to the combination of the interference with water distribution by other farmers, poor maintenance and general deterioration of facilities, crop damage and low price of paddy compared to production costs, which discourage farmers' efforts to attain higher yields per hectare. The government has instituted operation and maintenance fees, but the farmers do not adhere to the schedule.

3.4. CROPPING CALENDAR

The reorganization of agricultural regions into three appropriate produced areas relates to their classification into three regions according to specific characters aims primarily at improving, conjointly with farmer's groups or single farmers, appropriate cropping and production systems and cropping calendar for optimizing water use and increasing the cropping intensity of these systems, through a prepared cropping calendar. The choice of crops is done together by farmers and government regional structures, which are charged to improve irrigation at farm level.

The cropping calendar is communicated to all water users who are informed that water releases will be in accordance with the calendar. In more irrigation sites with more over 20 hectares, farmers do not adhere to the schedules due to delays in acquisition of credit, seeds and fertilize, or to the lack of mobilization of labour or constitution of funds for the credit's counterparts or the maintenance of canals and pumps that cannot be undertaken by the government due to lack of funds. The delays in the agricultural inputs stem from the support agencies that make them available. Because of their higher cost, in more cases, feedbacks of selling problems to the farmers have not made. But where successful delays in cultivation and planting have been registered, the adoption of cropping calendar increased cropping intensity of the systems.

3.5. TRAINING

The urge to improve the village small-scale irrigation development process encouraged the establishment of consultancy agencies for the training of the farmers. But because of the lack of appropriate capacity building programme, poor incentives and appropriate training for irrigation systems operation and maintenance personnel is perceivable. The training programmes focused on soil and water relationships, water requirements, water allocation and scheduling and maintenance procedures, but there is a very need in trainings which are able to resolve institutional problems, such as successful methods and approaches for farmers' participation identification and implementing.

3.6. WATER MANAGEMENT

During the implementing phase of all the actions and measures to allow water management improvement in small-scale irrigation development scheme, many approaches which tend to organize farmers in each turnout more specifically with a view to facilitating the conflict resolving process and the coordination between the management of the main system and the farm level system have been considered. But in more cases, farmers do not adhere to these and perceived these programmes as serving the interest of the local authorities rather than theirs.

IV. RECOMMENDATIONS

In small-scale irrigation systems constructed and maintained by the government through its regional coordinating committees, efforts must be focussed on increase of irrigation fees collecting by framers themselves. In Burkina Faso, experience shows that governments are unable to allocate an adequate amount to cover the recurrent cost of the systems. In more cases, enforcement through group pressure and social sanctions by members of well organized irrigation associations is more effective than legal action by the government. Experience indicate too that collecting of established fees in order to pay irrigation systems' construction and maintenance should take into account the paying capacity of farmers. In addition, where farmers have sufficient paying capacity they often prefer to pay irrigation fees instead of contributing labour and materials directly.

Obtained experiences through the implementing of pilot actions and measures to test approaches for increasing farmers' participation showed that it should begin in all the stage of identification and choice of sites, planning processes and construction and development phases. In more cases, the use of recognized and catalysing farmers-water users and agricultural extension operational personnel should be indicate. In addition, it would be recommendable to have interdisciplinary groups, consisting of members skilled in engineering, agriculture management, sociology, economics and specialist of producers training and capacity building to assist the pilot project in planning interventions, analysing resultants, and designing improvements.

It is essential that the capacity building in the agricultural extension services charged to assist farmers should be interdisciplinary and should base on a learning process approach.

PARTICIPATORY IRRIGATION MANAGEMENT IN PAKISTAN: OPPORTUNITIES, EXPERIENCES AND CONSTRAINTS

Abdul Hakeem Khan[1], Mushtaq Ahmad Gill[2] and Aamir Nazeer[3]

ABSTRACT

The contiguous Indus Basin Irrigation System of Pakistan covering an area of about 17 million hectares has been mostly operated and maintained by the government under the 130 years or so old Irrigation and Drainage Act of 1873. The mismatch between expenditures and revenues from the irrigation system resulted in continued deferred maintenance leading to poor performance and widespread inequity in water distribution to farmers, especially the tail enders. The Provincial Irrigation and Drainage Authority Acts were passed in 1997 for establishing autonomous and financially self reliant bodies at all levels of the irrigation system. Pilot studies were conducted by establishing Farmer Organizations (FOs) for transferring the operation and maintenance of the secondary irrigation system to them. The transfer of management was either partial, the so-called joint management, where the public agencies and FOs were managing the system jointly; or a complete transfer of management to FOs. The level of success has been varying from system to system and from province to province depending upon the motivation, capacity building and willingness of the agencies involved. There were cases where system performance had considerably improved in achieving a higher level of equity in water distribution, higher cropping intensity, higher revenues collection, reduction in conflicts and reduced operation and maintenance costs. Results from other systems with quasi participation of water users or the government departments have not been encouraging. The involvement of different organizations in different places with limited expertise, experience and resources for water users mobilization, capacity building and lack of democratic approach for establishing water users associations and organizations have been major factors for poor participatory irrigation management experience. While, experience with committed, expert and experienced organizations had been the other way round. Political involvement and fear of loss of authority have also contributed its share.

1- Head, International Water Management Institute (IWMI) Pakistan 12 KM Multan Road, Lahore, Pakistan. Phone: +92 42 5410050, Fax +92 42 5410054, Email: a.khan@cgiar.org
2- Director General, On-Farm Water Management, Directorate of Water Management, Agriculture Department, Government of Punjab, Lahore, Pakistan
3- Economist, International Water Management Institute (IWMI) Pakistan, 12 Km Multan Raod, Lahore, Pakistan.

INTRODUCTION

The deteriorating performance of irrigation systems due to lack of maintenance funds and vandalism in many Asian countries has been contributing to widespread inequities in water distribution. Poor management of available scarce water resources has led to lack of viability and availability of water during critical periods of crop growth. In large canal schemes in South Asia, it is common for one-third to one-half of a tail end of a designed service area not receiving water form canals. Numerous research studies by International Water Management Institute (IWMI) have documented the pervasive problem of inequitable water distribution in canal irrigation schemes in Pakistan, India, Sri Lanka and Indonesia (Merry, 1997). Similarly the gap between cost recovery and operation and maintenance (O&M) expenditures has been widening with the passage of time. The estimated operation and maintenance requirement in Pakistan was about US$5.70/ha compared with the actual expenditures of about US$2.70/ha (Skuteh, 1998). Low and declining rates of cost recovery are key threats to the sustainability of irrigation systems. Revenue collected from water charges equaled or exceeded the expenditures in the 1960 and early 70s in Pakistan. But, by the 1990, revenue collected from water charges was only 44 percent of O&M expenditures, fro surface irrigation (Vermillion 2005).

Participatory irrigation management (PIM) has been advocated in order to overcome the maintenance and management problems of irrigation systems. With the passage of time, irrigation has become more than a technological process and its management goes beyond the management of infrastructure to include management of human relationships between irrigators, water uses, organization officers and others (Coward 1980). Coward called for research on the human and organizational dimension of irrigation management and that irrigation should be considered as a multi-faced socio-technical enterprise.

THE IRRIGATION SYSTEM

Pakistan has the largest integrated irrigation network in the world. The system is fed by the waters of the Indus River and its tributaries. Since 1947, Pakistan has implemented the Indus Basin Replacement Works Project (IBRWP) with the World Bank's help as the lead donor. The salient features of the system are three major storage reservoirs, namely Tarbela and Chashma on the Indus River, and Mangla on the Jhelum River; 19 barrages; 12 inter-river link canals; 45 independent irrigation canal commands; and over 140,000 watercourses which are complemented by a surface drainage system comparable in size (Figure 1). The length of canals totals 61,000 kms, and in addition watercourses, farm channels and field ditches cover another 1.6 million kms. The system draws an average of 130 billion cubic meters (BCM) of surface water each year for irrigation, supplemented by an annual groundwater pumpage of some 53 BCM. With nearly 80 percent of the agricultural land being under irrigation, irrigated agriculture contributes significantly to the economy of Pakistan, where 25 percent of GDP, 50 percent of employment, and 70 percent of export revenues (directly and indirectly), are from agriculture (World Bank, 1997).

PRESENT STATUS

Although irrigated agriculture contributes significantly to the country's economy, Pakistan's irrigated agriculture suffers from waterlogging and salinity, over-

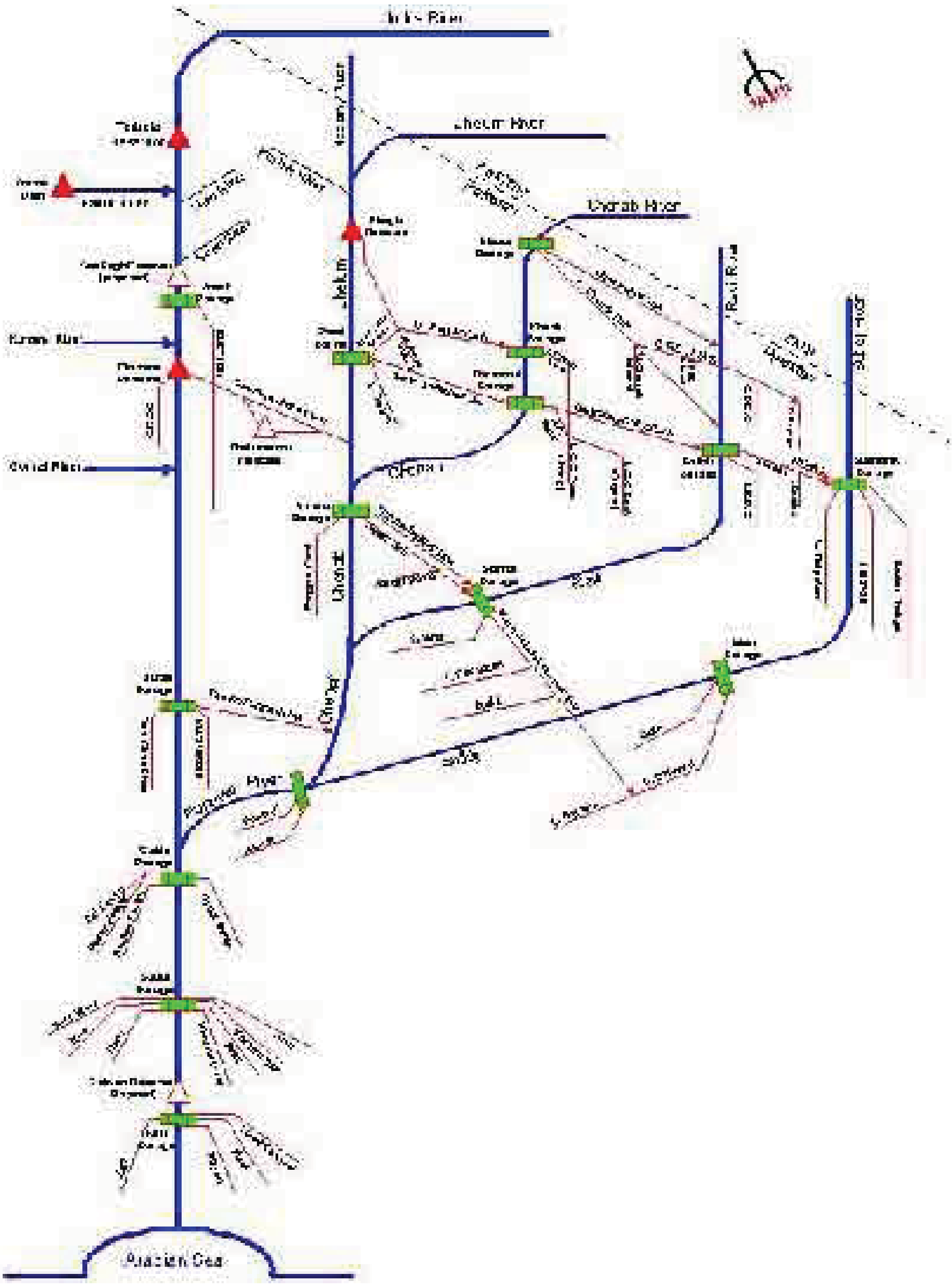


Figure 1: Indus Basin Irrigation System.

exploitation of fresh groundwater, low efficiency in delivery and use of irrigation water, inequitable distribution and unreliable delivery of water, and from insufficient cost recovery of irrigation and drainage charges. Waterlogging and salinity are the principal threats to the sustainability of irrigated agriculture in Pakistan. Nearly thirty eight percent of the Gross Command Area (GCA) is waterlogged, of which 15 percent is severely waterlogged. Fourteen percent of the surface is saline, of which 6 percent is severely saline. Salinity is estimated to rob farmers of about 25 percent to the potential production of major crops. Due to age, overuse and poor maintenance, the efficiency of delivery of the canal system is low, ranging from 35 to 40 percent from canal head to the root zone. Furthermore, the system which is based on gravity flow, is supply-based and has low use-efficiency. Inefficient water delivery and use also mean that, in reality, water does not reach many users toward the tail-end of the system. Inequity in the distribution of surface water –due to deliveries less than design levels, poor O&M, and even illegal diversion—is a major concern in Pakistan. Operation and maintenance is inadequately financed. Cost recovery of O&M is perennially inadequate. For example, the gap between O&M expenditures and recoveries in Punjab was 62 percent in 1994-95, and increased to 74 percent in 1995-96; and the gap between O&M expenditures and revenues in Sindh was 89 percent in 1994-95 and 88 percent in 1995-96; and the gap between O&M expenditures and revenues in Sindh was 89 percent in 1994-95 and 88 percent in 1995-96. Many users and polluters of drains do not even pay for the use of drainage infrastructure. For example, urban centers and industries dispose of municipal waste and toxic effluents in canals and drains without payment or regulation. The poor state of drainage O&M is reflected in the periodic need for rehabilitation at roughly five year intervals (World Bank 1997).

FARMER MANAGED SYSTEMS

Pakistan is country where irrigation and water management is done both by the state as well as the water users themselves. The centuries old Karezes in Balochistan, the civil canals in the North West Frontier Province (NWFP) and the Rodkohi and Sailaba (Spate irrigation) in NWFP, southern Punjab and Balochistan are all farmer managed irrigation systems with no involvement from the government. Water users have developed their own rules for operating and maintaining these systems since centuries. Civil canals have been serving 0.33 million ha of land in NWFP, while the Karezes have been serving about 0.10 mha in Balochistan. The irrigation from hill torrents is practiced on about 0.095 mha.

Public involvement in water resources management started with the introduction of properly regulated and large irrigation systems during 1850s and afterwards, when water users were not given any management role above the tertiary channels. The first amendment mad by the government for involving water users in water management was the enactment of Water Users Association (WUA) Act 1981. Under the Act, WUAs were involved in the construction of tertiary channels for improving the conveyance efficiency and reducing seepage losses in unlined channels. There are about 140,000 tertiary water courses in Pakistan which are being partially lined under a phased programe since 1976, where a part of the cost is being paid by the farmers, either in cash or in kind. The Government of Pakistan has now embarked upon a crash program of lining about 86,000 watercourses by investing US$ 1.1 billion in about four to five years (2004 – 2008) for saving water and improving productivity. The contributions coming from the WUAs in this National Program for Improvement of Watercourses (NPIW) are 22.1 percent of the total cost. However, the role of these associations has remained limited and have not been instrumental in the long run for improved and sustained efficiency of their watercourses.

PIM AT SECONDARY CANAL LEVEL, PILOT STUDIES

Organizing water users and handing over canal management responsibilities to them on bigger secondary canals was considered to be an impossible task before the International Water Management Institute (IWMI) and the Punjab, Provincial Agriculture Department through its On-Farm Water Management (OFWM) Directorate took on the pilot studies in southern Punjab and Sindh. IWMI conducted its studies on the Hakra 4-R Distributary (17,733 ha) of Hakra Branch Canal in Punjab and on Bareji Disty (5,728 ha), Heran Disty (6,164 ha) (under Nara Canal System) and Dhoronaro Minor (5,353 ha) (Rohri Canal System) in Sindh. The Sindh study was replicated on another ten channels after the success of the pilot schemes. While the OFWM carried out its studies on the Sirajwah Distributary and Bahadurwah Minor of Malik Branch Canal.

The studies were conducted almost simultaneously form 1994 to 1998 without a blueprint through a consultative and adaptive process between the organizing teams and the water users. Being pilot and research oriented in nature, these studies were conducted in the absence of any legal framework and without the involvement of the concerned irrigation departments (Khan 2006). These studies were conducted with the expectation and assumptions that the irrigation department would transfer the management responsibilities to FOs and that FOs would cope with the social and feudalistic forces for achieving equity in water distribution. The four pilot FOs formed by IWMI and two by the OFWM in Punjab and Sindh have been termed as excellent in all respects, i.e. orientation, clearance of objectives, awareness and capacity building and discharge of responsibilities. But, it took about two to three years for these organizations to establish these FOs. The social mobilization and awareness phases took considerable time for the water users to understand the concept and be willing to accept the new responsibilities. Also, all the process was more democratic and consensus oriented.

These studies were a major breakthrough in the irrigated agriculture of Pakistan when Farmer Organizations (FOs) were formed, and registered with the Provincial Irrigation and Drainage Authority (PIDA) under the PIDA Act 1997. The management of pilot schemes was transferred to FOs under the irrigation management transfer agreement signed between PIDAs and FOs. An important aspect of the pilot channels was that they were adequately rehabilitated before management transfer. All the important control points, outlets and cross sections were improved with the involvement of FOs for improved water conveyance and distribution.

Studies on irrigation management in East Asian countries have show that well-designed institutional arrangement can create a synergetic relationship between state and local farmers to ensure the productivity and sustainability of irrigation systems. Effective irrigation management requires that people understand and develop locally-appropriate institutional arrangements and division of roles between the state, the community of water users and the private sectors (Lam, 1999).

Limited work has been done on evaluating the overall performance of these FOs. Field studies conducted by IWMI on Sindh farmer managed irrigation systems show considerable improvement in the hydraulic performance of the concerned irrigation canals. FOs mobilized their resources and ran a "desilting campaign" in their respective channels in order to convey water to tails. Figure 2 shows that water distribution (delivery performance ratio [DPR], the ratio of actual to design discharge) had significantly improved. Most of the channels were drawing more water than their design allocation, however, the tails were proportionately getting much less, before the desilting campaign. Water distribution improved substantially after silt was removed all along the channels. Most of the tails started getting increased supplies as is evident from Figure 2, while Mirpur, Belharo, Potho and Bagi Distributaries were very much benefited. Another important observation was that most of the channels were drawing more than their design discharge with the exception of Khattain Minor, before the maintenance activities which was reduced thereafter.

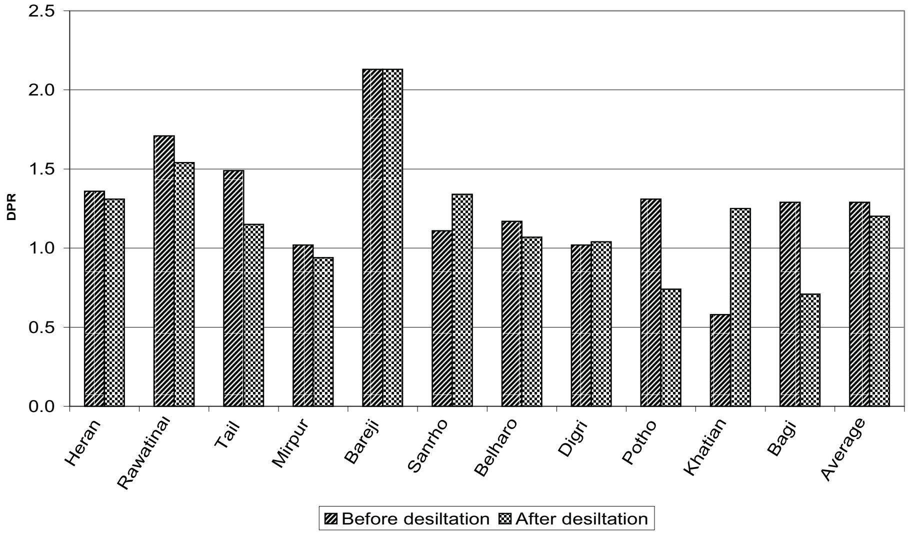


Figure 2a: Water delivery at head.

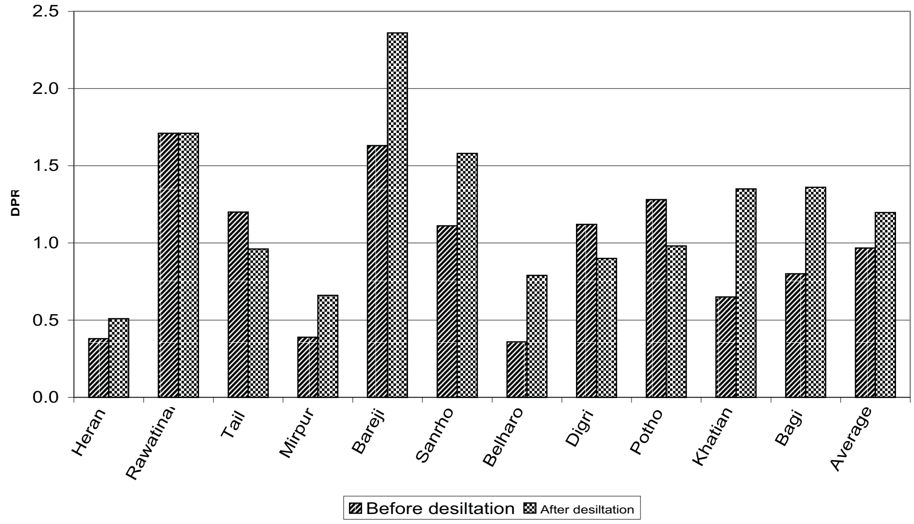


Figure 2b: Water delivery at tail.

Lashari et al 2003 have reported that the maintenance carried out by FOs was about \$0.45 per ha which was only 40 percent of the water fee that farmers were expected to pay. This was a substantial saving for the government which could not meet the increasing maintenance cost. Another study carried out on the Pilot Hakra 4-R distributary has shown that the hydraulic aspects of the irrigation services delivered by FO had significantly improved resulting in highly proportionate and equitable water distribution at the tail reaches of the distributary. Tampering with outlets had been almost eradicated and an increase of about 6-7 percent had been reported in the irrigated area. Similarly revenue collection improved by about 14 percent for Kharif (summer) season and by about 23 percent for Rabi (Winter) season (Latif 2003). The Hakra 4-R FOs achievements were more than just water management. For example, the FO opened a joint bank account, collected money from members to purchase cotton seed and distributed it to members for cultivation. When empty bags were not available for harvest, they collectively approached the government and obtained the bags (Nakashima).

The experience with the pilot farmer managed systems has been quite encouraging, though they used a lot of support for their sustainability.

PIM UNDER NDP

The Government of Pakistan launched a massive National Drainage Program (NDP) of US\$ 785 millions mainly with the World Bank and Asian Development Bank assistance in 1997 in order to rehabilitate the irrigation and drainage infrastructure in the country. A package of major reforms had been agreed upon between the Government of and the donors within the framework of the NDP project. The reforms consisted primarily of decentralization and management transfer of the irrigation and drainage system from Provincial Irrigation Departments (PIDs) to a multi-tier system of autonomous institutions with clearly defined roles and responsibilities within the system, and with a firm commitment to phase out subsidies for O&M in seven to ten years. Consequently, the four provinces of Pakistan promulgated the Provincial Irrigation and Drainage Authority (PIDA) Acts in 1997 for transforming the existing provincial Irrigation Departments into autonomous and financially self-reliant entities. One of the major functions of PIDA was to introduce the concept of PIM through the pilot Area Water Boards (AWB) at existing canal circle level and FOs at the secondary canal level in about 7 years. Each PIDA was responsible for developing a legal framework, byelaws and regulations for their respective AWBs and FOs.

Basically, all the four Acts promulgated by the four provinces were almost similar in nature. They had provisions for farmers' representation at the Authority and for their role in important decision-making, but their enforcement varied considerably from province to province. The absence of a clear policy till very late regarding the number of farmers' representatives in the Authority and their selection/election or nomination by the government or FOs had seriously affected the process of PIM. Lack of awareness and capacity building of the irrigation department staff before initiating the process of AWB, FOs, the concept of PIM and the new role of the staff had created the impression of loss of job. The reluctance of the government agencies for transferring authority to water users and fear of loss of job especially at the field level cadre delayed the development of rules and regulations for proposed FOs.

Development and revision of by-laws and regulations for AWB and FOs took too long for every province, which delayed the process of trnasfering the O&M responsibilities to FOs. Punjab had done some work on these regulations in 1999 after two years of PIDA Act for the pilot FOs formed by IWMI and OFWM and have now finalized them during 2005. Sindh had developed some regulations but amended the PIDA Act 1997 during 2000 to be called Sindh Water Management Ordinance 2000 for incorporating the detailed functions and responsibilities of every institution under PIDA including tertiary watercourse associations. NWFP has not made major changes in the Act except increasing the number of farmer members from one to three in the Authority.

Sindh was leading in the formation of FOs where 206 FOs had been formed by the end of 2005 and Irrigation and Drainage Management Transfer (IDMT) agreements had been signed with 166 FOs along with the complete transfer of management to them. Punjab started late and had completed the first pilot AWB of Lower Chenab Canal Circle (LCC) East by transferring 85 secondary channels to FOs for joint management by December 2005. The NWFP PIDA had formed 49 FOs had signed Irrigation and Drainage Management Transfer (IDMT) agreement to 6 of them only (Table I). NWFP PIDA has provisions for joint management during the first year, however, FOs had concerns about the support and help form PIDA.

Table 1: Number of FOs, signed agreements and offtakes transferred.

Province	No. of FOs formed	No. of IDMT signed	No. of FOs with transferred management
Punjab	85	85	85
Sindh	206	166	166
NWFP	49	29	6

(Source*: PIDAs (Punjab, Sindh and NWFP)*

The fundamental objective of the irrigation and drainage sector reforms was improvement in water distribution equity and self-reliance of the autonomous PIDAs. Out of the total 340 FOs formed by December 2005, 257 FOs had taken over management responsibilities. However, limited information has been available on their performance so far. No independent and detailed study has been carried out for evaluating the farmer-managed systems for water distribution equity, crop assessment and revenue collection. Punjab has reported the following major achievements of the FOs managed systems during the first 100 days of their operation after March 2005 (PIDA 2005).

- Water distribution has improved as cases of theft of water have been controlled by about 80 to 90 percent as compared to previous years.
- Silt clearance activities have been carried out by many FOs on self-help basis.
- 14 out of 20 channels had 32 breeches during the 100 days due to weak banks.
- 146 disputes mainly relating to warabandi of watercourses were reported to FOs and disposed off.
- Progress on crops assessment in channels command was about 70 percent.

Internal reports from Sindh PIDA suggest considerable improvement in water distribution, recovery of water fee and conflict resolution. Latest information is lacking but the performance during 2001-02 has been encouraging. Overall water fee collection was 80 percent of the target for kharif 2001 and 50 percent of target for Rabi 2001-02. While FOs had collected 82 percent of water fee in Kharif 2001 and 45 percent in Rabi 2001-02, i.e. Nara Canal Pilot AWB. Similarly, water distribution had also improved where some of the tail reaches that did not receive water for many years had been growing rice (Haque 2003).

Another important aspect of the Pilot Area Water Board of Nara Canal in Sindh was the more democratic and transparent process of social mobilization and election of office bearers of FOs. Out of 100 registered FO in Nara Canal AWB, 47 FOs chairmen were from tail ends, 28 from middle whereas 25 were from head reach. 40 FOs chairmen held less than 18.25 ha of land, 23 were owning upto 40 ha while 37 had more than 40 ha (Haque 2003).

CONSTRAINTS IN PIM

Accepting a change is not easy, especially when it involves loss of authority and financial control. Even accepting a change or responsibility without an incentive is not forthcoming most of the times. The first proposal submitted by the World Bank in 1994 for introducing PIM in Pakistan had received considerable resistance as it involved transformation of provincial irrigation departments into commercially oriented public utilities. These utilities were supposed to be autonomous and financially self sustainable by adjusting water charges and had to be eventually privatized. According to the proposal farmers would take over the management of secondary canals and that water markets would be developed at different levels of irrigation systems. The proposal of privatization was not accepted by the provincial government because irrigation is a provincial subject. Government officials, officers from provincial administration, farmers and researchers debated over the feasibility of the proposed reforms proposed by the federal government.

The debate through seminars, workshops and media resulted in dropping the proposals of privatization and delinking water rights from land (Renaudo, Zubair, 1999). The farms lobbies also strongly opposed the first draft of PIDA Act for their insufficient representation. Another important constraint was lack of understanding and details about the proposed reforms. The first impression of privatization and water markets had created sufficient resistance that could not be easily eroded with the revised and improved PIDA Acts of 1997. The knowledge and skills gap among farmers and agencies need to be filled with a blend of skills and attitudinal changes at all levels including policy makers. Lack of capacity was one of the major reasons that took PIDAs to take several years for developing bylaws and regulations for AWB and FOs. And one of the major reasons for the success of pilot FO has been their proper training and education on technical, financial, administration and legal aspects of the irrigation systems.

However, the capacity building of other FOs formed by PIDAs and other agencies has not been as good as that of pilot FOs which would definitely adversely affect their performance. Social mobilization and capacity building of water users for a socio-technical and complex job of irrigation system is a time consuming and laborious process. Continuous support is always needed for effective and successful management transfer which is not the case with FOs formed by consultants within a short specified period, of the assignment. Irrigation Management with limited capacity of FOs and without back up support from PIDA may not produce the desired results.

The staff of the provincial irrigation departments especially the field level cadre, were not very encouraged to support the reforms process mainly for two reasons, one, loss of authority and financial control over a large part of the system (secondary canals and below) and two, the perception that water users did not have the capacity to operate and maintain the system.

REFERENCES

1. Coward, E.W. 1980. Irrigation and agricultural development in Asia: Perspectives from the social sciences. Ithaca, NY; Cornel University Press.
2. Haque, A. 2003. Sindh Irrigation Sector Reform: Presentation at World Bank on Water Week (March 4-6, 2003). Washington D.C.
3. James, C. 1996. Agricultural Research and Development. The need for public-private sector partnership: Issues in agriculture 9. Consultative Group on International Agricultural Research, Washington D.C.
4. Khan, A.H., I. Masih and S. Munir. 2006. Public-private partnership in water management in Pakistan; Experiences and constraints. Sixth Indo-American environmental leadership program. International workshop on water saving technologies, 23-24 February, 2006. Amritsar (Punjab) India.
5. Lam, D.W.F. 1998. Institutional design of public agencies and co-production: A study of irrigation associations in Taiwan. In M.D. McGinnis (Ed.), Polycentric

governance and development: Readings from the workshop in political theory and policy analysis (pp 296 – 325). Ann Arbor: The University of Michigan Press.

6. Latif, M., M. S.S. Pomee. 2003. Impacts of institutional reforms on irrigated agriculture in Pakistan. Irrigation and Drainage Systems, volume 17; 195-212, 2003. Kluwer Academic Publishers, The Netherlands.
7. Marry, D.J. 1997. Expending the frontiers of irrigation management research. Colombo, Sri Lanka. International Irrigation Management Institute (IIMI).
8. Nakashima, M. Undated. Water Users' Organization for Institutional Reform in Pakistan's Irrigation Sector. Faculty of International Studies, Hiroshima City University, Hiroshima, Japan.
9. Samad, M., and D. Vermillion. 1999. Assessment of Participatory Management of Irrigation Schemes In Sri Lanka: Partial Reforms, Partial Benefits. Research Report 34. Colombo Sri Lanka: International Water Management Institute (IWMI).
10. Skutch, J.C. 1998. Maintaining the Value of Irrigation and Drainage Projects (Report OD/TN 90) Wallingford, UK. HR Wallingford Ltd.
11. Smdren M., Trava J., Johnson, S.H. III. 2000. A Synthesis of Benefits and Second Generation Problems in D. Goeufeldt. And M. Sverdsen (eds), Case studies in participatory irrigation management.
12. Vermillion, D.Z. 2005. Irrigation Sector Reform in Asia: From Participation with Patronage to Empowerment with Accountability. Book on Asian Irrigation in Transition: Responding to Challenges (Ed). Sage Publications, New Delhi/ Thousand Oaks/ London.

ESTABLISHING WATER USER ASSOCIATIONS IN IFAD PROJECTS

Mohammed Bourass[1]

SUMMARY

1. The development of irrigated schemes has for a long time been contingent upon a centrally- planned and controlled policy emphasizing the importance of the investments carried out by the state in the sector. However, in the eighties, this centrally-planned development path in force was no longer considered appropriate particularly within the specific context of a free enterprise economy and state's disengagement from direct involvement. Fresh alternatives were considered involving a series of measures to delegate users increasing responsibility in matters pertaining to the maintenance of irrigation networks, direct management of farms, liberalisation of land left fallow, establishing Water User Associations (WUAs) and promoting water conservation systems.

2. Hence a new legislation better adapted to boost organization of Water User Associations was promulgated by the public authorities (Act N°2-84 on Water User Associations of December 21, 1990). Besides, the strategies put in place by rural development projects funded by the International Fund for Agricultural Development (IFAD) provide a concrete example to ease implementation of the participatory approach, with a view to upgrading locally-based development and management skills through training provision.

3. The report presents three examples in connection with IFAD- based projects whose main bullet points bring to bear on the following (i) the innovative capacity of the rural world with regard to inheritance of traditional lore and know-how;(ii) the increasingly important capacity of the farming world to open up and integrate innovative methods when they are deemed useful and profitable and (iii) the role of training programs, though in their simplest forms, can be considerably instrumental in enhancing capacity building of associations and ensuring long- term sustainability of irrigation infrastructures.

1- Mohammed Bourass is a rural engineer and IFAD consultant.

I. INTRODUCTION

1- Considerable efforts have been invested by the government of Morocco to harvest underground and surface water resources for irrigation purposes resulting in the construction of many storage dams throughout the country.

2- The development of irrigated schemes has for a long time been contingent upon a centrally planned and state-run policy on account of the investments made in the sector. In the preliminary stages, the state, as was often the case, substituted farmers in the decision-making processes. These extensive efforts exerted by the state in the field resulted in a dramatic increase of production in irrigated systems.

3- However in the eighties new developments occurred and it was noticed that this centrally-planned irrigation development pattern was no longer viable particularly within the context of a free market economy and the state's disengagement from direct involvement. New development-related paths were considered involving taking a series of measures, particularly those pertaining to increased users' responsibility in matters, such as maintenance of irrigation infrastructures, direct farm management through fallow liberalisation, establishing Water User Associations (WUAs) and promotion of water conservation systems.

4- These new orientations have not as yet contributed to fully attain the set goals, basically due to lack of reallocating the means available on the basis of newly identified goals and because of resistances inherited from past practices.

5- The current paper will give a brief overview on the development of Participatory Irrigation Management (PIM) through (i) the Water User Associations Act (ii) the strategies put forth by rural-based development projects funded by the International Fund for Agricultural Development (IFAD).

II. BRIEF OVERVIEW ON WATER USER ASSOCIATIONS ACT

6- In the small and medium-scale irrigation systems, renovation of traditional irrigation networks is generally compounded by a complex management system based on water rights still in use in the scattered farm holds. This practice of water rights is performed on the basis of community-pre-established and accepted criteria, with every grower receiving his share of water under the supervision of an official monitoring the smooth flow of work in each irrigation system. However, maintenance of community irrigation infrastructure in the districts is not always efficient (i.e. intake structures, primary and secondary canals). To offset these shortcomings, a new legislation on Water User Associations, better adapted to cope with the situation, was drafted and promulgated by the public authorities (Act N°2-84 on Water User Associations of December 21, 1990).

7- Hence, responsibility to manage renovated irrigation networks is entirely borne by farmers operating within WUAs. These associations of irrigation farmers are often made up of groups with previous existences in most of the conventionally-run irrigated systems and operate in compliance with the legal framework of the WUAs' Act.

8- The act provides for establishing WUAs in all irrigated systems where the state has created or developed facilities with a view to using the harvested waters for agricultural purposes. With this aim in mind, the basin agency proposes to the assembly of irrigation farmers the program of the works to be carried out in the district. It defines the financial and technical contributions it will make and the deadlines for work completion. The agency equally determines the expenses to be shouldered by the association, namely the water fees, the investments to be performed and the costs incurred by maintenance and operation of irrigation infrastructures.

9- Agreement of the eligible parties to set up associations is a prerequisite for project establishment in the small and medium-scale irrigation systems. Subsequent to the agreement reached between the WUA's general assembly and the basin agency on the work program to be carried out, the association is eventually created and is therefore empowered to sign contracts with the public authorities to start equipping the irrigation system.

10- When infrastructure-based projects are completed, minutes are signed between the association and the agency to transfer management of the irrigation system to the WUAs. From that moment onwards, the system will be run and maintained exclusively by the association. The agreement subsequent to the establishment of the WUAs provides for certain accommodating clauses and measures designed to cope with all the modalities pertaining to the management of irrigation systems, such as water distribution (water turns) and operation and maintenance of the infrastructure. Operation and maintenance tasks of the network basically encompass ensuring proper work –flow of water supply, efficient operation of irrigation structures and distribution (i.e. organizing water turns, cleaning irrigation canals, restoring to good condition of deteriorated simple civil-engineering structures and ensuring maximum protection of the irrigation system, etc.).

11- Through its governing board, the WUA is called upon to list down high priority actions and the modus operandi relating to maintenance works in accordance with the level of their importance (either to be carried out by the beneficiaries themselves or through outsourcing). Therefore, it is a requirement for the association to develop a good understanding and knowledge of the conditions of the irrigation infrastructure and of the network as a whole.

12- Costs incurred by operation and maintenance of the infrastructure will be met by the WUAs. All members of the association are expected to pay an annual fixed fee. This fee will feed into a fund in order to pay for specific maintenance works (i.e. concrete paving, masonry) and for staff compensations. Ordinary maintenance work (i.e. earth moving and canal cleaning) will be performed by the users themselves. Specific works, however, such as masonry or concrete paving will have to be performed by a mason who is a user resident in the district or through recruitment of a mason from outside the district (labour and construction materials bills are paid for from the community-based fund).

III. WUAS DEVELOPMENT STRATEGY IN IFAD PROJECTS

A. OVERALL OBJECTIVE AND POLICY STRATEGY OF IFAD PROJECTS

13- IFAD projects have been designed in such a way as to fit within government policies. Their overall objective is to contribute to eradicate poverty in the rural world through diversifying and increasing incomes of the rural populations in a sustainable manner and contributing to restoration and sustainable management of natural resource bases.

14- In the context of the participatory approach which is a key characteristic of IFAD project implementation, the proposals put forth to improve small scale irrigation are considered a top priority by the beneficiaries. Therefore, engaging in dialogue with them on this specific topic is quite smooth and not difficult.

15- Also, rehabilitation of irrigation networks will basically allow achieving the following: (i) increasing crop yields through increased and better distributed water volumes, (ii) increasing the share of water volumes made available to downstream areas of the main irrigation scheme, which do not very often receive irrigation water during peak or low stream flow periods and (iii) introducing highly productive crop varieties or even samples of new farm crops.

16- Implementing an approach based on strengthening training on all levels, including enhancing community-level awareness, outreach and counselling necessary to attain the goals of poverty eradication, to achieve sustainable development and ensure conservation of natural resources in project-based areas. The training of growers will bring to bear on utilisation, management and maintenance of farm implements and on upgrading farming techniques, without which water use efficiency will remain an empty slogan.

B. WUAS TRAINING IN IFAD PROJECTS

17- The strategic objective of IFAD projects is to consolidate management-based capacities and to prompt local development of rural populations with a view to improving their incomes, standards of living and ensuring their food security, with the overriding concern of achieving sustainable utilization of natural resources. This objective fits within the 2020 rural development strategy worked out by the Ministry of Agriculture ,Rural Development and Marine Fisheries, and which calls for the adoption of a participatory approach involving village-based teams to carry out the inventory work, ranging from soil analysis, establishing diagnosis, considering assets and constraints, defining and prioritizing relevant actions to be undertaken, exploring appropriate paths for their implementation including participatory management. Along those lines, the program consists in working out Village or Community-based Development Plans (VCDP), which can be derived by striking up a balance between the technician logic and the participatory approach calling for greater involvement of the grassroots' population.

18- In order to suitably play their role in operation and maintenance of rehabilitated and modernized irrigation systems, WUAs should receive direct backstopping and permanent advisory services provided by a close proximity department at least during the first years from their inception. This technical support should not only cover aspects pertaining to irrigation water management , but also should lead to improving agricultural productivity and intensifying production systems.

19- The establishment of associations is one of the most critical and necessary actions to perform for ensuring the lastingness of irrigation infrastructures. In compliance with the programs put forth by the Ministry of Agriculture, Rural Development and Marine Fisheries, IFAD projects have scheduled a training program to be delivered by a consultant-trainer recruited through competitive bidding open to the private contractors. The successful bidder will either be an engineering and design department, an NGO with expertise in the activity sector or possibly Moroccans with recognized skill qualifications.

20- The proposed training program will relate to the five following sessions: (i) to kick-start, focus will bring to bear on the participatory diagnosis to systematically identify most salient weaknesses and to facilitate educational group activities according to the needs and key characteristics of the irrigated district; (ii) community-based administrative and financial management (Record keeping and the WUAs secretariat, budgeting of operations, management of current accounts and funds, financial follow-up and financial statements); (iii) rational distribution of water among users in the district and water use at field plot-level taking account of factors, such as soil, crop requirements, plot layout and site preparation for irrigation water; (iv) establishing sound maintenance practices likely to ensure sustainability of irrigation infrastructures; (v) protecting water resources from pollution; and (vi) methods, instruments and procedures for setting goals to be attained in addition to medium-term planning of actions to be performed by the WUAs.

21- To complement the five sessions, a specialized session will be hosted to sharpen the skills needed by treasurers and secretaries. This sixth session will deal with issues related to financial management of WUAs for the benefit of treasurers and management of administrative problems for secretaries.

22- The training course will take place over the span of 4 days for each WUA, with a 2-day course in-situ (i.e. the local headquarters of the association for example) and a 2-day field trip. Between each session, a 5-week period is extended to the trained members to carry out a mini action project which they have been able to design during the session and to share the multiplier effects with the users in the course of the meetings they will have with them.

C. WUAS DEVELOPMENT EXAMPLES IN THREE IFAD PROJECTS

Case 1: Rural Development Project of the Eastern Middle Atlas (PDRMO)

23- Community-based traditional organization of the populations in the villages of the project area is still predominant in several places. It is reflected through the simultaneous performance of a multiplicity of tasks (i.e. tillage, crop harvesting, house construction, laying out of irrigation canals, etc), management of irrigation water, conflict settlement between village members or between villages themselves on issues pertaining to defining the boundaries of the farm holds or of the villages.

However, the community (jmaa) does not have existence in law and cannot, therefore, engage in any partnership-related scheme with the administration or deal with management of public funds. Its members provide memory support services to the community with regard to irrigation water distribution methods, water share for each user as well as the boundaries of the farmsteads and villages.

24- In parallel to this, the area has witnessed an increasing development pattern in the form of village-based associative and co-operative movements which have been gaining ground. Indeed since 1999, 31 development-driven associations have been created in the project area and are quite active, particularly in matters relating to agricultural development, livestock -breeding and environmental protection. In addition, some WUAs, operating at district level, have proven their worth in ensuring maintenance of irrigation networks, water management and for conducting follow-up of rehabilitation work.

25- Within this framework, 73 WUAs are operational in the Boulemane province, of which 20 are located in the project area, discharging work particularly in the communes of Sarghine, Enjil and Skoura. Sometimes, the leadership in charge of these associations (i.e. the President, the Secretary General, and some Board members) are university graduates.

26- In this regard, it is particularly important to underscore the fact that several of these WUAs are the brainchild of the jmaa (traditional community-based form of organization). Several have been created subsequent to a request filed by the jmaa to take advantage of the development programmes extended by the government. Indeed, the IFAD project has been able to notice that the leadership of several associations is mainly made up of members of the jmaa and their relatives. The decisions are collectively taken in agreement with the jmaa's standpoint. Support to formally-set up associations, particularly those involved in rural development and management of the socio-economic infrastructures, seeks to respond to the following (i) the national policy to strengthen capacity-building of civil society components and increase population involvement in national development-based issues; (ii) the strategy put in place by IFAD and (iii) the requests expressed by the associations and the jmaas to benefit from development projects.

Case 2: Rural Development Project in the Mountainous Area of Al-Haouz Province (PDRMH)

27- 17 rural communes are targeted by the rural development project of the mountain areas of Al- Haouz province (PDRMH) .To give concrete substance to villagers' involvement in the work, an Annual Contract Program (ACP) is signed with project management. This ACP encompasses all actions identified and defined by the village population including the rights and obligations of the concerned parties. The activities listed in the action plan are scheduled for implementation and can be financed by the PDRMH.

28- Rehabilitation of the small and medium-scale irrigation is very crucial, since the latter is a very important project component expanding over 4,000 ha area, of which 25% in high and 40% in medium valleys and 35% on the foothill.

29- The project has adopted the participatory approach as a basic strategy within the context of a sustainable development perspective to better allow the populations to identify their needs and structure their actions accordingly. Hence, in discharging its duties, the project has benefited from partnerships established with development-driven associations for implementing the action programs. The numbers of associations recorded in the Al- Haouz province as well as the growth pattern of associative demography highlight the increasingly important role of the associative movement.

30- In addition, the wealth of information derived from the participatory culture of the local populations is a considerable asset for the project. Indeed, in these 'so-called' marginal areas (especially those of the Talat N' Yacoub commune) local citizenry have learnt to close ranks, work cooperatively and adopt traditional patterns of organization in order to respond to unmet needs by the public sector. Consequently, they are more flexible to adapt to the community-based form of organization put forth by the project.

31- **Association Involvement.** The contribution of recipient populations is multi-faceted. Initially the PDRMH provides a framework for the populations to express their dissatisfaction. In this preliminary stage, focus is on formulating the needs in an exhaustive manner.

32- In general, in the course of the preparation of the study files of irrigation networks, the association takes part in the choice of the layout and negotiates with the engineering and design department the type of irrigation canal it deems suitable. During the execution of the work contract, the association also takes part in monitoring the work, in particular the proportioning of concrete and steel reinforcement.

33- Usually, the association appoints one or two people (often masons or people with experience in the construction sector) to monitor concreting. The discussions initiated with some associations showed that they had sufficient information on the quantity of concrete proportioning they wanted (the required number of wheelbarrows of aggregates per cement bag), the number and diameter of steel bars to be used and the type of cement.

34- It is a pity; however, that the association is not able to receive the execution plans prior to work implementation so that it can participate in monitoring the work rigorously. The availability of the execution plans as well as the orientation training that can be provided to the association to help it read these plans will be extremely helpful to the project. The people working within the association are the ones with a permanent presence on the construction site, in contrast with the technicians or the people from the engineering and design department who undertake periodic visits to the area.

35- The contribution of various associations is often carried out in the form of labour to do the earthworks, the pitching and concrete laying. The price units of the various contracts applied to these quantities allow computing the amounts payable by the beneficiaries. The table hereafter synthesizes the results by commune.

Rural Commune	Work Amouts	Kind of Contribution			Contribution Amount (Dh)	Contribution Rate (%)
		Earthwors (m3)	Pitching (m²)	Concrete (m3)		
Azgour	7 101 441	820	365	62	159 316	2.2
Ighil	4 857 926	377	753	-	59 350	1.2
Imgdal	3 823 139	1 385	523	-	46 764	1.2
Ijoukak	2 839 597	841	523	39	132 890	4.7
Total	18 622 104	3 422,85	216 475	10 135	39 832 101	2.1

36- It seems that labour contribution ranges between 1.2 % and 4.7 % among the 4 communes of the high valleys; the average is 2.1 %. This apparent low rate of contribution is indeed very significant and reflects the degree of population involvement. It is directly linked with the poverty level of the populations who do not have the base resources to take part in the work. In this regard, it is worth recalling that the project strategy focuses initially on and targets support for the most destitute and underprivileged villages in the project area.

37- **Capacity-Building of Associations: Work Monitoring.** In this regard, increasing capacity-building of associations to monitor conducted work is one of the most practical project recommendations since it will make it possible to back the work initiated by the technical departments of the ministry. Indeed, the human and material resources available (cars, travelling expenses) do not allow the engineering department to engage in an ongoing type of assessment given the limited staff number, on the one hand, and the number of construction sites scattered over a vast area with difficult points of access, on the other. The major constraint is the multitude and dispersion of the irrigation systems in the project area. Conducting a regular and constant follow-up of the various construction sites is therefore impossible to perform mainly because the sites are scattered all along the high valleys of Ighil and Aghbar, the Piedmont and mountain region of Amizmiz and the middle valleys of Asni.

38- A solution to the problem consists in involving the beneficiaries themselves through their associations to take part in monitoring and follow-up of work. Thus, within the framework of the Association - Project partnership, it is possible to consider giving increased responsibility to the association to discharge follow-up and monitoring of the work on a permanent basis. This will require training association members to upgrade the skills in connection with the reading of plans, sizes and concrete proportioning (cement, aggregates) and reinforcements.

39- This task is within reach and is not a problem since there are always masons or workmen in the village with sufficient skills in the construction sector. Moreover, associations have expressed their readiness to perform such a task. In fact, in many localities this monitoring has already been put in place. What is most needed is a contract to formalize this relationship, and especially the provision of training to members of the association to discharge monitoring efficiently. Associations are, therefore, capable of assimilating these technical aspects if training is engineered and administered adequately.

40- The benefits accruing from such an approach are vast and varied. There is no question that it is the best way to enhance responsibility of the beneficiaries and increase their involvement in the project. It is also a form of contribution in work delivery. Finally, it is a kind of training and an initial preparation for shouldering prospective maintenance work of the irrigation infrastructure.

Case3. Rural development project in the mountainous area of Errachidia province (PDRME)

41- This project is still at the formulation stage. However, provision of training to the WUAs, as has been stated earlier, is a fundamental component in IFAD's project implementation strategy. In addition to this, fresh proposals are suggested for action.

42- The thrust of the action is to be able to determine on the basis of measurements using stream gauging, i.e. to be provided by the project, the discharges transiting through the traditional irrigation canals or séguias. For all of the irrigation systems, measurement of de facto discharges and of the volumes conveyed by the network transport and distribution systems is a key element in the decision-making process relating to irrigation network operation. The set goals to be achieved are the following: (i) gain complete mastery of water transport in the networks; (ii) initiate and kick-start maintenance and rehabilitation works (a priori) and their assessment (a posteriori); (iii) address water shortage management issues; (iv) develop conflict arbitration procedures; (vi) council exemption; (vii) provision of a database on discharges and water volumes; and (viii) ensure efficient water resource management within a participatory framework.

43- There is an absolute requirement for the technical departments of the Tafilalet regional office of agricultural development (ORMVATf) and the local user organizations to have tools available for measuring water discharge. Decision on the location of these measurement points will be made in close collaboration with the local institutions and the beneficiaries (WUAs and ORMVATf). The ultimate goal of such a system is to make it possible for the various stakeholders to have a database on discharges and on water volumes to ensure efficient water management within a participatory framework.

44- For implementing such a system, it is necessary to provide training for proper installation and operation of the system to the ORMVATf technicians and to those in charge of the WUAs.

45- The WUAs will be gradually involved in the process. Initial work will be started with those which are available and express a real interest into this type of activity. Most importantly, focus will be on involving WUAs with users who are literate and have a school background.

46- The discharge measurement activity (and therefore of water volumes) is of a strategic nature, because its success (i.e. involvement and project ownership by the WUAs) will be a breakthrough in the role played by WUAs, which will then be in a position to take over the prerogatives shouldered by the Jmaa previously (i.e. role of managing irrigation networks, water shortages and conflict settlement). Consolidating the role and the legal entity of WUAs is the best course of action to ensure sustainability of irrigation infrastructures.

IV. CONCLUSION

47- The innovative capacity of the rural world combines perfectly with heritage of traditional lore. The farming world is quite open to innovative methods when they are useful and profitable. Training courses, though quite simple in their design, can contribute considerably to enhance capacity building of associations, the best guarantor of the sustainability of irrigation facilities. This should lead to increasing soil productivity and boosting agricultural production efficiency.

THE NEED FOR PEOPLE PARTICIPATORY MANAGEMENT IN PROGRAMMING THE WATER RESOURCES; CASE STUDY MESHED PLAIN.

Dr. M. H. Popoli Yazdi[1]

ABSTRACT

The main objective of this paper is to present the result of many social and economic studies done by the author on the problems of water shortage in Meshed Plain.

The paper analyses the present water shortage situations in Meshed, the government proceedings to solve the problem, the role of people participation and cooperation to support the government, the traditional systems of people participatory cooperation and finally, gives a view on the future if the present model of participation would continue. In analyzing the previous and the present agricultural projects, it seems that the main guilty ones for the present water crisis are the university, Iran and overseas consultative advisers and governmental programmers. These educated bodies did not predict the shortage of water for today and in their agricultural development proposals offered to the government some years ago, they put the most water demanding industries and dependant agricultural products, e.g. sugar beets products, that were not compatible with Meshed resources of underground water. At the end of the paper the author suggests his preferred model for optimum use of underground water in Meshed plain.

INTRODUCTION

The development from the top, without consideration of people views and local knowledge, had been a mutual aspect of the thought of development in the majority of the countries despite capitalism or socialism regimes. The result of getting a development from top to down where people wants and local knowledge were ignored, became the cause of many Social problems such as unwanted migration of farmers to the cities, deep differences in social classes, revolutions and political changes that resulted in environmental problems, decreasing natural resources and many different kinds of pollutions and health problems. The development from top and based on benefit alone became the cause of deterioration of people's rights and the nature rights. This procedure continued until the year 1970. The resulting environmental problems

1- Amayesh Consulting Co., Social adviser to Razavi and North Khorassan water companies on the water management at the down stream of some new constructed dams. (Moddaress University)
Address: No92, between Behar and Khayyam, Tell: 0511- 7640040 Fax: 0511-7621658
E.mail: info@amayeshco.com

came to a point that the scientists and thinkers of development issues decided to change their approach to development.

In the post modern age, the environmental issues came into the institutional laws of the countries. The article of No. 50 of I. R. Iran institution was also allocated to the environment. From the other side, the discussions on people participatory and formation of associations[1] were brought to the attention of policy-makers by thinkers and specialists.

The practical following of the issues resulted in an international quorum so that most of the countries included the issues of people participatory and people associations in their institutional laws.

In IR of Iran, too, the articles of 106 and 107 of the third Iran Development Plan and also in 4th Development Plan the people participation and formation of people associations on the water issues are included. I.R. of IRAN, considering the total country policy that was a return to Iran origin, reducing government roles in economical management, giving people affairs to themselves and solving the social and environmental

Problems and economic usage; approved the participatory managements and formation of associations in the 4th Iran Development Plan.

IRAN STRATEGY FOR PARTICIPATION OF PEOPLE ASSOCIATIONS ON WATER ISSUES IN PLAINS INCLUDING MESHED PLAIN.

From 1948 when the first country development plan was approved, the development policy was followed without attention to environmental issues, people wants and local knowledge. This policy presented from the top has resulted many social and environmental problems today. This paper is not to find the problem creators and condemn the guiltiest. But it is to clarify the problem to introduce the guidelines for improvement.

We must distinguish the real persons or institutions responsible for the existing environmental problems. if the people are the cause of all water shortage in plains and they are the cause of critical water problem including the water shortage in Meshed plains, we should introduce the guideline for **reduction in agricultural water use**, the guideline is being followed now by government with an approach to development and popularization from the top to down, that is, pressure from the top, fines, control water use by intelligent counter equipment and determination of the water use right from the wells, increasing the rate of electric charge, prevention of further deepen the wells, preventing the replacement of wells and bring a bill from the courts to stop water using from the wells.

But if we realize that the guilty ones are the development programmer, economic theorizing experts, banks, universities and consulting companies, and in summary all

1- In this paper the word ASSOCIATON means any kind of group such as: stock shared Co., Cooperatives, Trade association Etc.

the governmental agents as the principal cause of the existing water crisis and shortage of water in Meshed plain, then we must present a different solution and that is to **reduce the water demand** instead of **water use reduction**. The second hypostasis needs another kind of water management that would be more complicated and more extended than management for water use reduction. In an approach with reduction demand, the big users of water in food industry or city users of agricultural water should change their views on water consumption. The much water use products should be produced in a region with much water availability.

In an approach with decreasing the demands of water, the replacing, improvement and sometimes closing the big agricultural industries in some regions is necessary. The sugar beets industrial factories, tomatoes concentrated industry, fruit conserves, and other similar industries that are the big consumer of agricultural waters should change their activities in some regions that critical shortage of water exist. In an approach with reduction in water demand, in addition of the farmers, users of service water, city potable water, and city green gardening should also participate in optimum use of water.

For investigating and clearing the cause of Meshed present critical shortage of water we must see who has proposed the agricultural objectives and strategies in Meshed plain. Those who have determined the agricultural objective without correct prediction of underground water for today, are the guiltiest for the situation we are confronted as a critical water use today.

In a report of the Scetcoop Company[1] in 1970 approved by the Iran budget and plan organization of that time, Meshed volume, page 88, in describing of agricultural objectives in Meshed plain, we read that:

Agricultural Objectives:

In agricultural products, sugar - beets needed for sugar factories, should be provided first and then establishing the other big new projects of agricultural industries such as stations of producing fruits, vegetable oil factories for sunflower and the factories for producing foods for husbandry.

The recommendation of Setcoop, a French engineering adviser, was accepted by the government of the time in decade of 1961-1971. This is correct that Scetcoop adviser Co. has mentioned the limited potential of water in Meshed in different pages of his report, but the adviser has suggested finally the cultivation of products that need a lot of water. The fruits product in Meshed was 50000 tons. Scetcoop, in a 20 years landscape has suggested 204900 tons of fruits and grapes and also 206000 tons of grass (husbandry food) for Meshed plain to be cultivated.

In 1961, the policy for agricultural development of Meshed plain predicted by Scetcoop consultant was to develop industrial food production which mostly depended to much

1 – SCETCOOP ETCOCEAC PARTIA, Plan de development du Khorassan, Vol. 1 Meshed, 1972

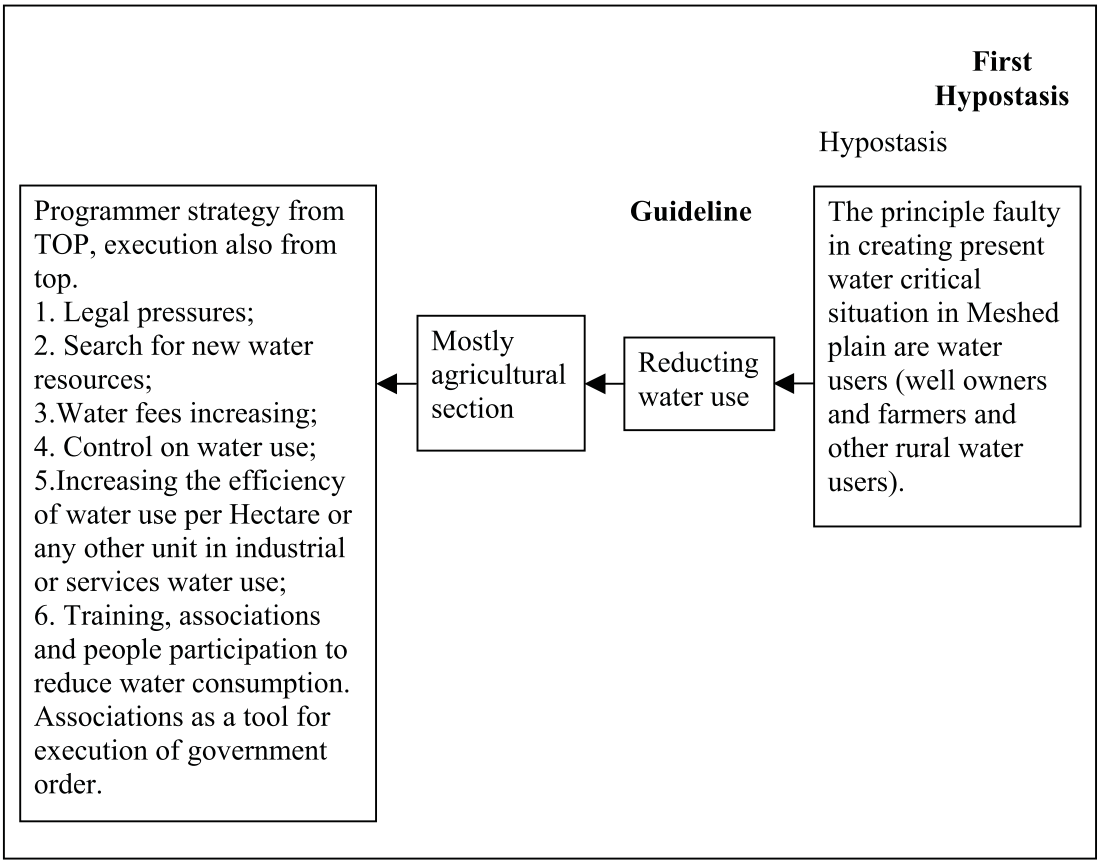
water consumption, that is develop in horticultures and cultivations with highly demand of water.

You may suppose that from existing 6008 underground water wells in 2005, 1000 wells have been dug and used without governmental permission but is it possible that people have established so many sugar factories, Conserves and concentrated tomatoes industries which consume most of the underground water for cultivation of needed products without bank cooperation and governmental permission?

Scetcoop Company in 1970 predicted Meshed water use in 1987 for 583 million cu.m. Underground water use in Meshed from 6008 water wells was 91 million cu. m. in 2004.

Water use from 403 springs was 9000000 cu.m and from 895 Qantas was 85000000 .In total, Meshed water use was 1085 million cubic meters .If the programmers in 1961 had planned the long-term projects of development upon the land and water capacity of the region and agricultural potential, they certainly would had proposed less water use agricultural projects for Meshed plain. The advisers should have proposed the high water used agricultural projects such as sugar-beets factories and food industries with high water demand for the west of Iran instead of Meshed, where big water sources such as Charkha, Karoon, Dez and other large rivers exist. If they had proposed a correct policy for agricultural development, we would not have such a critical water situation in Meshed. Unfortunately the present situation would lead us toward a dependency to international sources and Iran will experience the Hirmand again in Meshed. The present critical situation in Meshed can not be solved unless having people participatory assistance in all the country with having big objectives in national and regional level based on a strategy that guarantees the agricultural development. There is urgency for a legal and financial layout for above mentioned purposes with a national decision and will.

I propose some models for problem solution. These models should also be completed by other experts and critics.

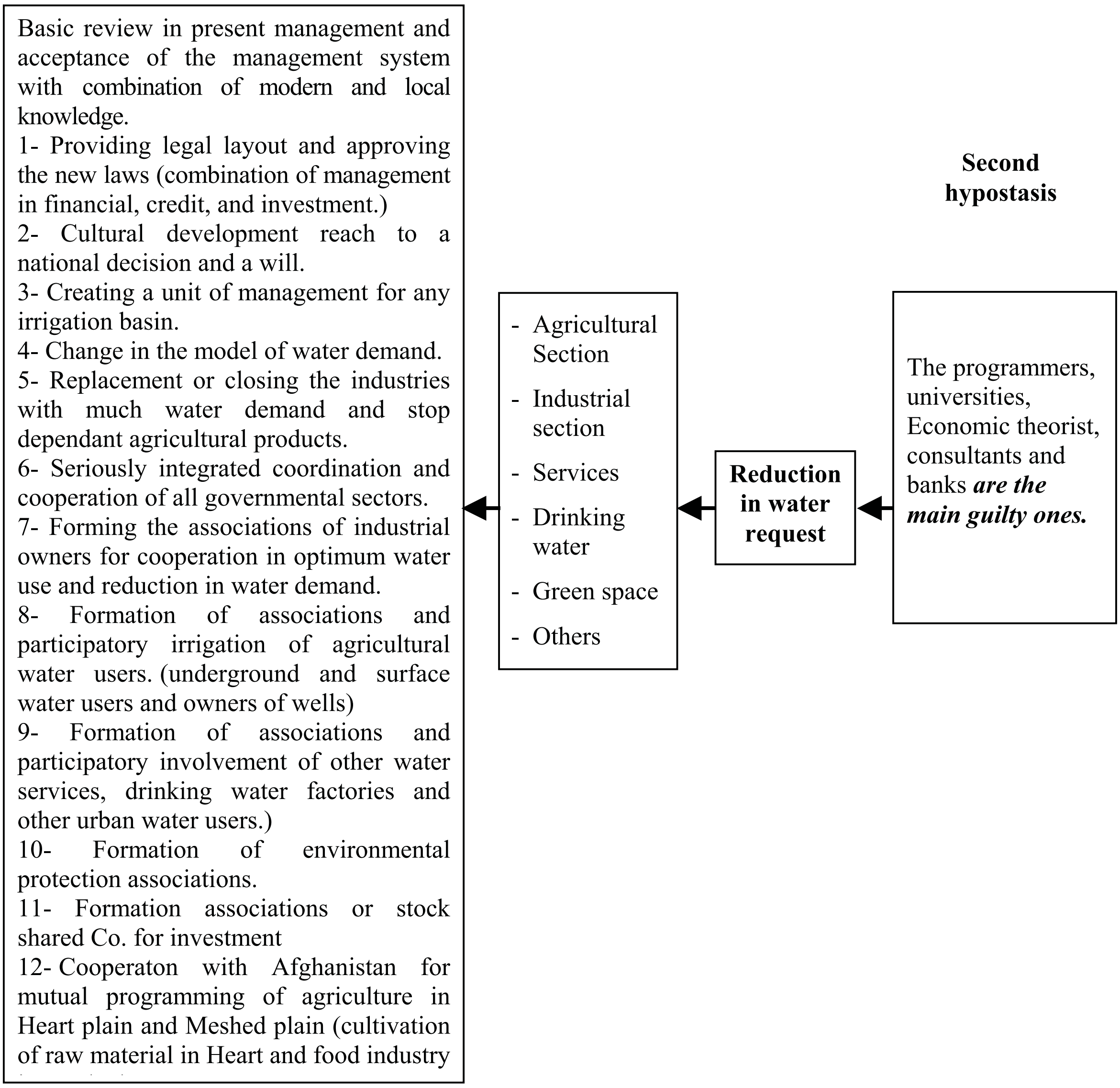


Model 1 the principle guilty for the critical water situation in Meshed are agricultural water users.

With attention to Model no.1 it seems that the hypostasis should be rejected because the people are not responsible for the system structure. People are trapped in the governmental agricultural system and they are not the principle guilty for the shortage of underground water. So we should find the guilty in the governmental and high educated higher programmers. The people are sub- guilty bodies in the system. If we accept the second hypostasis we should choose the guideline of reduction **in water demand** instead of **water use reduction**. Then the following proceedings are needed:

1- All industrial water users including agricultural, industrial, city services, drinking water and Etc. by accepting the idea of participation choose the method of participatory management in water using and support the government in optimum use of water. People should be seriously involved in water problems through associations by solving the problem in a participatory way.

2- The total policy of programming and management should be changed so that a country approach towards the patterns and systems of participatory management using modern and local knowledge together in water management could be changed ...

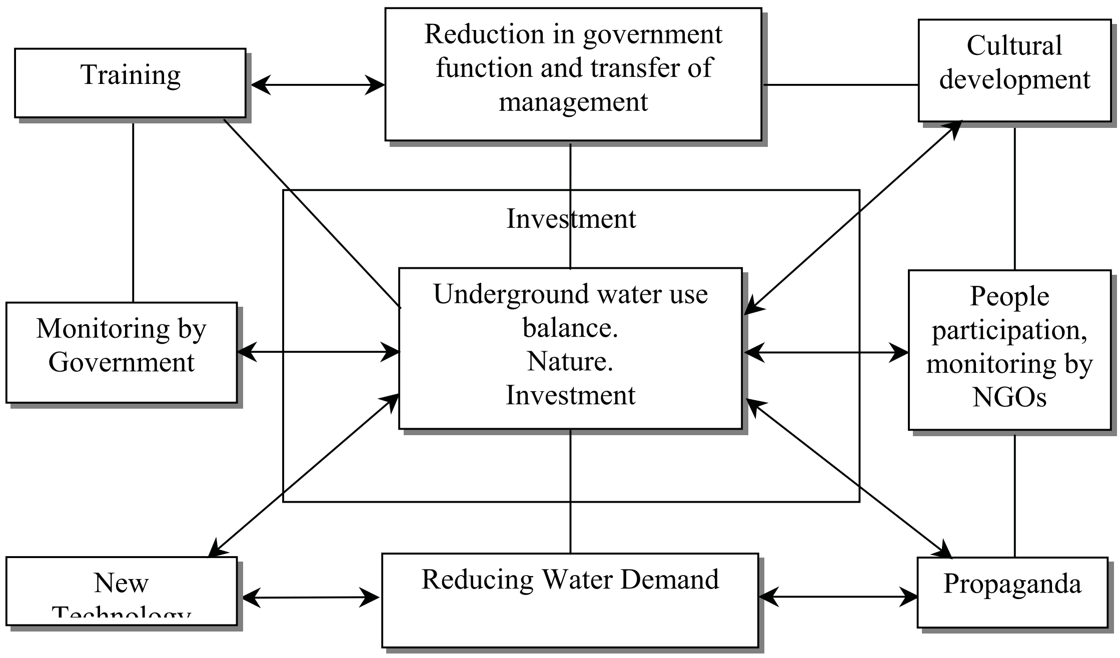


Model 2- second hypostasis: the principle guilty in creating critical water problem in Meshed are programmers and Bank system.

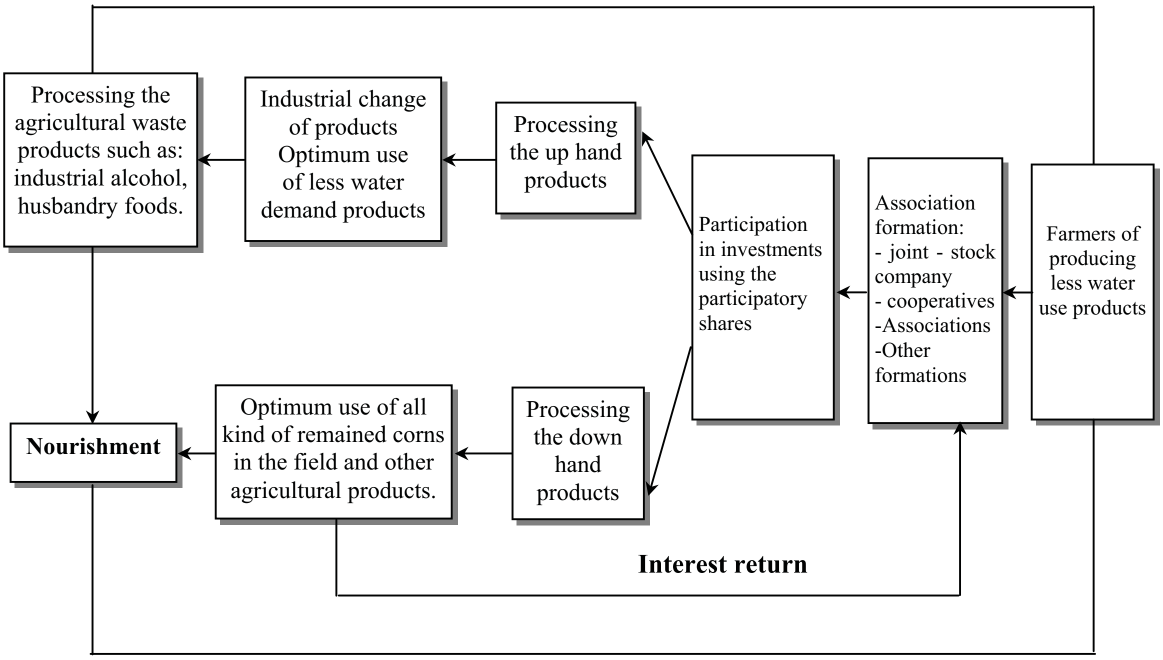
To reach a balance of underground water use both presented models are recommended, But the principle model in the author view is the model No 2.

Government should precede the approved laws on water management that will result in reduction of governmental function. The transfer of water management to people organizations (associations, stock-shared companies, cooperatives, etc.) should be executed and government should thank people participation. Government could only monitor people on water management.

It should be noted that transfer of management is completely different with stop of management. It is about 80 years that government has got the local and people management in his hand and it is difficult to change a trend of 80 years governmental rule in a quick change. The transfer of management to people association takes a long period of time and it should be done step by step accompanied with training, creating self-sufficiency, self believing, motivation and cultural training. This procedure needs a step by step strategy and in a 4-year-experience of mixed governmental and people management experience, the associations would get enough experience to follow the management independently. The needed regulations and manuals for a four year cooperation of participatory management should be prepared and approved by the governmental board of Ministers. The government should decrease being in charge of everything, instead it must increase policy making, monitoring and coordination role, side by side with NGOs. Cultural training, propaganda, training and using technology should be accompanied with transfer of management.



Model 3: The model of underground water use balance

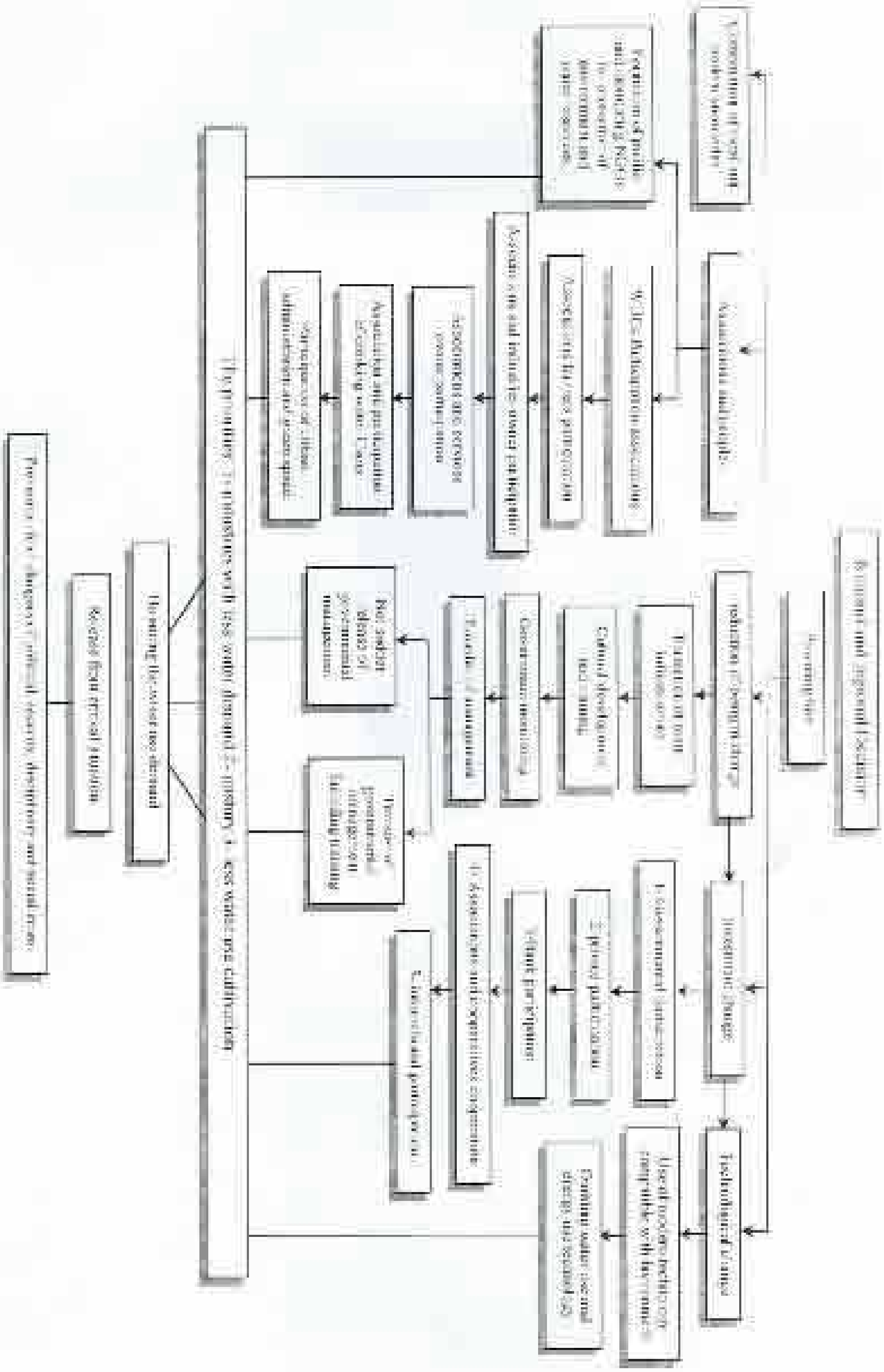


Model 4: Continuous Economic System

Continuous economic system through formation of associations and farmer participation on the objectives of:

1- **Reduction in water demand**

2- **Increasing the farmers income.**



model 5: Balancing of the water use demand

At the present time, the investment in agriculture and food industry, processing the higher and lower products is done completely separated from each other. It is necessary that markets be found through researches find a guideline through a bourse market for the total agricultural system and dependant industry or formation stock, hold companies or other formation for the total system, take away this interruption and involve the benefit of all investors either farmers or industrialists in the benefit or loss of the system. At time being, the producers of the raw agricultural materials claim that they are losing their investments. So the government should not only omit the tax from the agricultural system but also subsidize this economic sector. Unlike the raw producers of agriculture, the food industries allocate all benefit to themselves. Neither peasants have share from the benefit of food industry nor do dealers nor dealers and owners of food industry have share in farmer's loss.

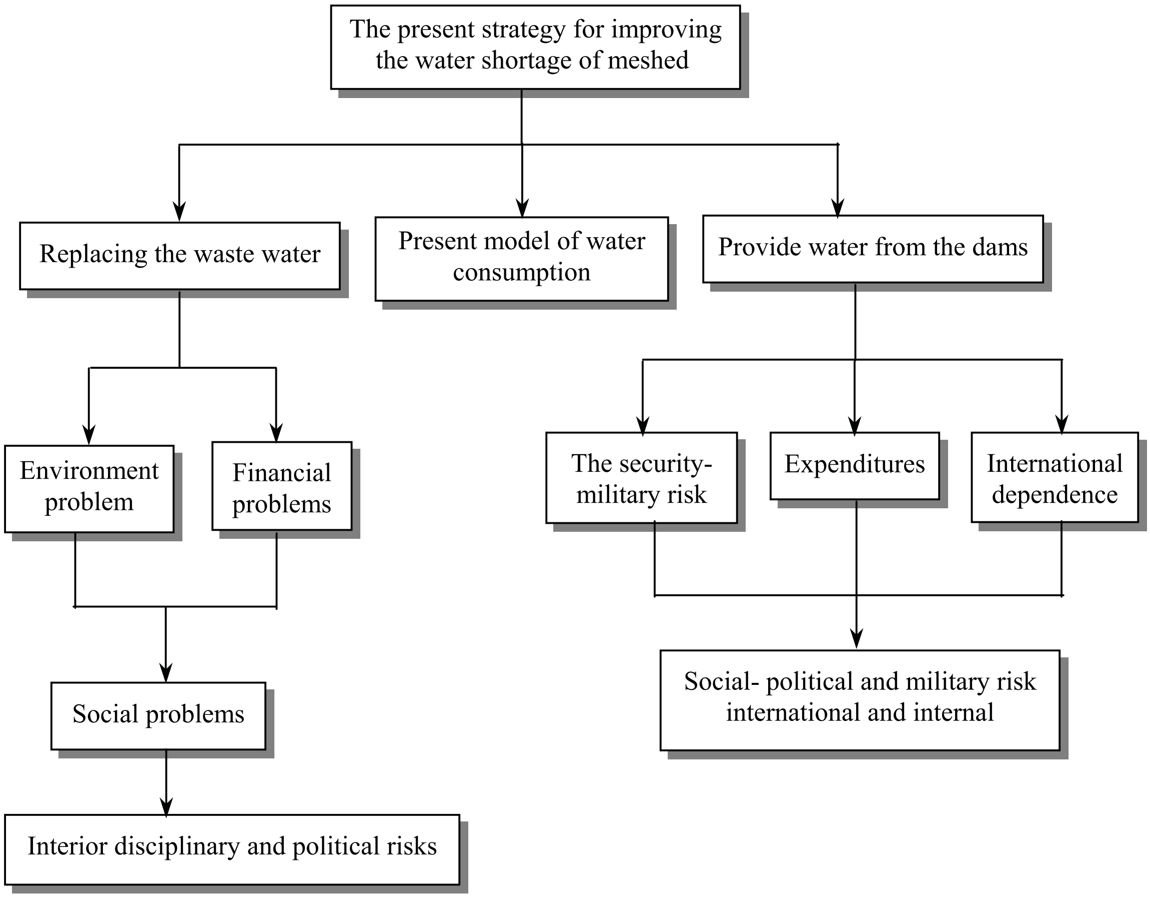
If this model (that should be completed) is preceded, the situation for reduction in agricultural water demands and the replacement of the sites of water users industries from the critical plains to other place including from Meshed, would be possible.

RECOMMENDATION AND PROPOSALS:

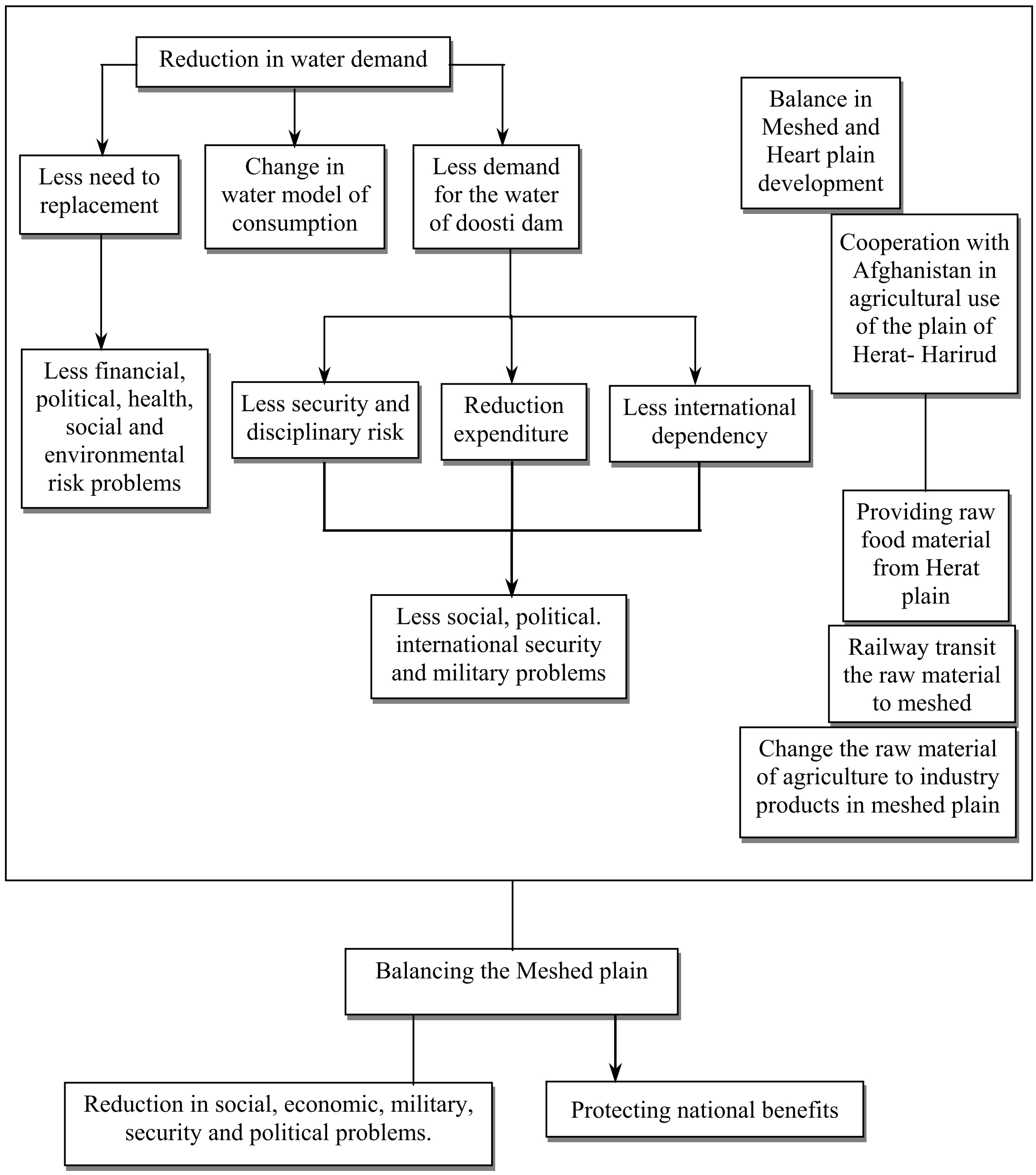
1. Attention should be paid to the deep idea of this article that is: changing attitudes from management of water use reduction to water demands reduction and from critical management to risk management.
2. The formation of people associations should be considered seriously. Participatory Irrigation Management is not just financial but participators should be involved in deciding and making decisions, management, execution and financial maters in such a way that management transfer from the government to the people would be possible step by step.
3. The different form or kind of associations should be studied before formation

   So that the formation of association be compatible with local culture and with

   Regional climatology. Although the form of association is studied mutually by the Ministry of Energy (deputy to water resources) and the Ministry of Jihad Keshavarzi (Agricultural Ministry) and the trade union is chosen for the underground water users, but this form of association should frequently be examined and tested.
4. The people should not be introduced as the principle guilty for water critical situation and water shortage. The main are governmental programmers, Iranian and overseas advisers and universities educators'. we, educated advisers, are the guilty ones and we should improve the situation. If the educators, advisers and programmers are the guilty ones, we should not blame the people for water use and ask or fine them for what that is not their fault.



Model no 6: the Chart of Critical Management



Model 7: The Preferred Model: Risk Management Chart

REFERENCE:

1. Adib Soltani, Mirshamsadin, 1980, Religious Thesis (Persian), Iran Center for Studding Cultures, 220 pages.
2. Azkia, Mostafa, 1989, the theories of non-development, Geographical Research Quarterly, No. 13.
3. Afroogh, Emad, 1998, Space and Society and Social differences (Persian), Tarbiat Modaress University, 341 pages.
4. Popoli Yazdi, M.Hossein, Hassanpoor Razavi, Jalil, (1986), Yazoo, a sample of traditional group system of users in the North of Khorassan (Persian).
5. Popoli Yazdi, M. Hossein, Ebrahimi M.Amir,(2002),Rural Development Theories (Persian), Semat Publication, 306 Pages.
6. Farhadi, Morteza, (2002), Environment Crisis in Iran and necessity to restore it with local knowledge, Nemayeh Research Magazine, No.12-14, Special issue traditional knowledge and technology
7. Farhadi, Morteza, 19994, Cooperation Culture in Iran, Vol. I Cooperation in irrigation and cultivation, the center for University Pub, 432 pages
8. Naghavi, Naghib, 1368, The traditional irrigation in Nehbandan and its Qanat., Geographical Research Quarterly, No. 14
9. Iran Ministry of Islamic Guidance, 1989, I.R. of Iran Constitution
10. ORESTOM (1984) Le developpememt rural en questions
11. International Network on Participtory lrrigation Manayement.
12. United Nations University 287p
13. WWW. Uneso. Org / water / Ihp
14. www.undp.org, United Nations Development Programs.
15. www.unicef.org, United Nations children’s Fund.
16. www.copac.org, How to start a cooperative, cooperatives information report.
17. www.inpim.org, International Network on Participatory Irrigation management.

IRRIGATION REFORMS IN PUNJAB PAKISTAN: REVIEW OF IMT MODEL AND FRAMEWORK

Aamir Nazeer[1], Abdul Hakeem Khan[2], And Shaiq Hussain Aabdi[3]

ABSTRACT

The new demands and challenges for food production and security combined with the persistent poor performance of the agency-managed irrigation system in Pakistan has led the Government of Pakistan to transfer the management of irrigation systems from provincial irrigation agencies to Farmer Organizations through the Provincial Irrigation and Drainage Authorities (PIDAs). In the Punjab, pilot Area Water Board (AWB) has been established and irrigation management has been transferred to 85 Farmers organizations (FOs). This paper reviews and evaluates the existing institutional and legal framework, implementation model & methods as well as the roles & responsibilities of the stakeholders by taking the Punjab province as a case study with a purpose to analyze the existing reform structure and process in terms of providing opportunities for establishing and strengthening autonomous sustainable institutions at all levels of the reform process. The institutional & legal framework as well as the structure and functions of stakeholders are well defined and the reforms have taken off but yet there are certain doubts and fears about its sustainability. The on-going reforms is influence by a number of internal and external factors; like the opposition from stakeholders themselves, changes in leadership, influence of personalities, lack of political commitment, lack of consistency & continuity and the change in the strategy and implementation model. What is needed for successful sustainable reforms is a strong commitment of all the stakeholders, devoted leadership and collective actions of the farming community under existing socio-political and environmental realities of Pakistani system.

1- Agricultural Economist, International Water Management Institute, 12-Km, Multan Road, Thokar Niaz Baig, Lahore; e.mail: a.nazeer@cgiar.org; Ph: +92-42-5410050; Fax: +92-42-5410054
2- Water Resources Specialist, Head, International Water Management Institute, 12-Km, Multan Road, Thokar Niaz Baig, Lahore; e.mail: a.khan@cgiar.org; Ph: +92-42-5410050; Fax: +92-42-5410054
3- Manager, Social Mobilization, Social Mobilization Cell, PIDA, Lahore; Ph: +92-300-4644050

INTRODUCTION

The Indus Basin Irrigation System (IBIS) of Pakistan serves as a lifeline for sustainable irrigated agriculture and is of central importance to the economy of the country. Since eighties, it was widely recognized that the irrigation system has not been performing productively, mainly due to improper/inadequate maintenance of the huge hydraulic infrastructure as well as the declining level of irrigation management services. This resulted into inadequate, unreliable and inequitable water supplies that further lead to physical and financial non-sustainability of the system and consequent stagnating productivity of irrigated agriculture in the Indus Basin.

Keeping in view the new demands and challenges for food production and the persistent poor performance of the agency-managed irrigation system, the Government of Pakistan (GoP) opted for fundamental institutional reforms, coupled with investment to improve the efficiency and performance of the physical system. The World Bank proposed to implement broad-based institutional reforms in 1994 and a reform program was prepared by a task force group including policy makers and water experts. All the four provincial assemblies passed Provincial Irrigation and Drainage Authority Bills. Under the on-going reforms, the Provincial Irrigation Departments (PIDs) have been transformed into financially autonomous entities, as Provincial Irrigation and Drainage Authorities (PIDAs), for their respective provinces. The PIDAs will comprise of a number of Area Water Boards (AWBs) and each AWB controlling a canal command area. There are 43 canal commands in the IBIS, divided as 24 in the Punjab, 14 in Sindhh, 3 in NWFP, and 2 in the Baluchistan province. Under each AWB, Farmers' Organizations (FOs) will be establishing to take over the responsibilities of distributary (secondary channel) management. So far, the PIDAs have been established in all the four provinces while pilot AWBs and FOs have setup in Nara canal in Sind, LCC (East) in Punjab, and Upper Swat Canal in NWFP.

About six years have passed since the irrigation reforms started – PIDAs and pilot AWBs have been established and management has been transferred to a number of FOs formed in the pilot areas, however, the reform process is still controversial with very unclear understanding among the stakeholders with a number of questions in mind about its sustainability. The present paper reviews the existing structure of the irrigation reform process in the Punjab province of Pakistan by synthesizing the available literature and data. The main objective of the paper is to review and evaluate the existing institutional & legal frameworks, implementation model & methodology as well as the roles & responsibilities of the stakeholders (PIDA, AWB, and FOs) by taking the Punjab province as a case study. The purpose of this endeavor is to analyze the existing reform structure and process in terms of providing opportunities for establishing and strengthening autonomous sustainable institutions at all levels of the reform process. This will help to understand the strengths & weaknesses of the reform process for improved irrigation management and a better reform process.

IRRIGATION REFORM PROCESS IN THE PUNJAB: A CASE STUDY

AN OVERVIEW

Irrigation system in the Punjab province of Pakistan is a part of IBIS and serves an area of 20.8 million acres (PIDA, 2005a). It is now widely accepted that the financial constraints coupled with the management deficiencies are central to the poor irrigation performance of the Punjab irrigation system and IBIS as well. The major problems include low cost recovery, inadequate maintenance funding & unsatisfactory maintenance, low level of services with general lack of agency responsiveness, unauthorized irrigation, low irrigation efficiencies, and inadequate, unreliable & inequitable water supplies. Realizing the deepening crises in water management and the irrigated agriculture, irrigation reforms in the Punjab province of Pakistan were started in 1997 after the PIDA Bill 1997 was passed by the provincial assembly of the Punjab on June 1997. The initial negotiation process was lengthy having two negotiation arenas, in which different actors negotiate over the scope, the intensity and implementation schedule of the reforms and it took about two years to come up to the present model from the original World Bank proposal (Nakashima, 1998; Rinaudo and Tahir, 1999; Dinar, et. al., 2004; Sarwar, 2006).

The initial documentation, legal frameworks and establishment of pilot AWB at Lower Chenab Canal (LCC), East Circle, Faisalabad in the province was carried out by the year 2000 (PIDA, 2005b). In 2002, the PIDA in Punjab rationalized its strategy differing from the original FO model and new rules for pilot FOs were approved which provided farmers' participation in irrigation management through a joint management phase (PIDA 2005a). On acquiring capability to operate and manage the irrigation system independently by these FOs during joint management phase, transfer of irrigation management was made operative. For the purpose, farmers based organizations at watercourse level i.e., Khal Punchayats (KPs), and distributary/minor level i.e., Nehri Punchayats (NPs) were established which will assist FO (at major distributary level) in its work.

IRRIGATION REFORM MODEL

The concept of original reform model (of privatization of irrigation system) proposed by the World Bank, including the introduction of water markets and individual water rights was not accepted by the GoP. After a long policy debate the government adopted the concept of decentralization and participatory irrigation management. The strategy evolved by the GoP incorporated most of the elements proposed by the World Bank, however the Public Utilities (PU) organized at the canal command level (proposed by the World Bank) were renamed AWBs and a regular authority, named as the PIDA to be established at the provincial level. The GoP did not explicitly ruled out the possibility of privatization, neither did it exclude the possibility to create tradable water rights that would be de-linked from the land property (Rinaudo and Tahir, 1999). Thus, the on-going irrigation reform model is based on three key elements of decentralization, participation, and management transfer.

INSTITUTIONAL FRAMEWORK

The new institutional frame, under irrigation reforms, is based on three-tiered management system, including mainly three entities of PIDA, AWBs and FOs. At provincial level, the PID is acting as the Irrigation and Drainage Management agency and in the process of being transferred into autonomous PIDA. The PIDA has been established with an equal representation of government's and farmers' representation and would have the complete autonomy of' revenue collection and spending with proper accountability. Under the new set-up Minister for Irrigation would be the chairman of the authority, with six farmer members nominated by the government and five non-farmer members including the Chairman Planning & Development (P&D) Board, Secretary Irrigation & Power Department, Secretary Agriculture Department, Secretary Finance Department and Managing Director PIDA.

Under PIDA, there would be a number of AWBs operated at canal command level as provided in the PIDA Act, 1997. Pilot AWB at LCC (East) Canal has been setup and includes a representation of farmer and non-farmer (government) members. The Chairman and Vice-chairman of AWB would be elected out of farmer members while in total there are 10 farmer members (elected out of FOs) and nine non-farmer members who are the representatives of allied government departments and technical experts.

Under the participatory model of on-going reforms, Farmers Organizations (FOs), Nehri Punchayats (NPs), Khal Punchayats (KPs) have been formed through a comprehensive legal framework. KPs are comprised of a chairman and four executive members elected out of farmers of a watercourse. Chairmen of all watercourses located on a major distributary constitutes the general body of the FO while a management committee elected from FO general body consists of a president, vice president, secretary, treasurer and five executive members (three from tail reaches of the distributary).

LEGAL FRAMEWORK

The Punjab Irrigation and Drainage Authority (PIDA) Act, 1997, legislated by the Provincial Assembly provides the legal framework for establishing PIDA, AWB and FO. The underlying principal of the Act is to decentralize the operation and maintenance functions and reduce government subsidies in particular for irrigation and drainage (Dinar et. al., 2004). The Act is mainly to provide for the participation of water users from Watercourse (tertiary to secondary/distributary) to main canal (primary) levels and even beyond at the Authority's level, for specified functions.

The main objectives of the PIDA Act includes; (i) to streamline irrigation and drainage system for more responsive, efficient and transparent arrangements; (ii) economical and effective irrigation and drainage system management in the Province; (iii) ensure sustainability of irrigation and drainage infrastructure; (iv) introduce and pursue the participation of beneficiaries in the operation and management of irrigation system (Qureshi, M.A. and Haq, A.U., 2006).

As the establishment process of reforms moved forward, the government of Punjab approved Area Water Board Rules, 2005, and the Farmer Organization Rules, 1999/2005, under the PIDA Act, while another set of five rules and regulations was approved by the authority, PIDA, including; (i) Farmers Organizations (elections)

Regulations, 1999, (ii) Farmers Organizations (Registration) Regulations, 1999, (iii) Farmers Organizations (Financial) Regulations, 2000, (iv) Farmers Organizations (Conduct of Business) Regulations, 2000, (v) Irrigation Management Transfer agreement between FO & AWB/PIDA

FUNCTIONS OF STAKEHOLDERS

In the on-going transition process there are three main stakeholders and expected to perform a well defined set of functions, while the PID has the role of overall policy regulation and overseeing. By implementing the present model, the management functions of PID are being transformed to the PIDA. The newly established PIDA, as an autonomous entity, representing the government as well as the farmers, is responsible for functions, like control on water delivery at provincial level, maintenance & development of the system, improving irrigation performance, optimizing water use efficiency, introducing the concept of participatory management, undertaking measures to improve assessment and collection of Aabiana (water charges), and sometimes sales of water beyond amounts contracted with AWBs.

The AWBs are responsible to perform, more or less, the same functions (like PIDA) at canal command level. The AWB would manage and distribute irrigation water, through formal volume based contracts with FOs, and trade water with other utilities. The main function of the AWB is to govern the operations and maintenance of Irrigation System, to assist the PIDA & government in the formation, promotion and development of FOs and monitor their functioning and performance.

The FOs are mainly responsible to obtain contracted amount of water from the main canal and supply it to the irrigators equally (on equal share basis), to operate and manage the distributaries, resolve the water disputes, and assessing & collection of water charges and making payments to AWBs as against their due share. In addition to the specific functions of the FOs, the major functions designed for NPs and KPs at the level of their own organizational framework, include; (i) Participate in the assessment of water rates, in deciding objections to the water rates, assessment remission of water rates, distribution of bills, and persuade the water users to pay the water charges; (ii) maintain the watercourse (through voluntary labor) and channel and undertake and supervise the maintenance, repair and development work of the channels; (iii) supervise the work and assist to the Canal Officer for necessary matters and assist the Irrigation Officers in the formulation of regulation plans; (iv) supervise and monitor the gauges and discharges of the channels and report tempering of outlets to the management committee; and (v) conflict/dispute resolution and assist the FO as directed by the FO or authority.

PRESENT STATUS OF REFORMS

Presently, reforms are in progress in the Pilot AWB of LCC East, where a total of 85 FOs have been established so far at distributary level and irrigation management has been transferred to them by December 2005 in three phases (20 in March 2005; 49 in June 2005; and 16 in December 2005) (PIDA, 2006). The pilot AWB established in February 2000 would start functioning as an autonomous body by December 2008. The reform process would be extended throughout the province in different phase/batches whereas the whole reform process would be completed by the end of 2025 (Annex Table 1) in which 24 canal commands of the Punjab province would be accommodated in 18 AWBs. PIDA has already introduced grouping of FOs and has estimated feasible size for an IMT unit, which is ranged between 40,000 to 50,000 acres (average) of CCA. Based on this criterion, 32 IMT units have been identified for the management transformation of 85 FOs in the pilot AWB.

The KPs, NPs and FOs are key starting point for introducing Participatory Irrigation Management (PIM). A total of 3666 KPs and 153 NPs in pilot AWB of the Punjab province were established up to 2004 while 233 NPs were formed outside pilot AWB, in other canal zones of the Province (PIDA, 2005a). These NPs were operationalized after necessary capacity building and training in different areas of irrigation management. Similarly, the FOs established under new PIDA rules of 2005, have started functioning after Transfer Agreement between PIDA (through Chief Executive AWB) and the management committee of the established FOs.

FO PERFORMANCE

Limited information is available on the performance of FOs established under the on-going institutional reforms and probably, no independent study has been carried out by a credible organization for assessing the performance of these organizations. However, the Monitoring & Evaluation Cell of PIDA has reported the major achievements of the 20 FOs (first batch of transformation) managed systems during the first 100 days of their operation after March 2005 (PIDA, 2005b). The key points were;

(a) Improvement in water distribution, as cases of theft of water were reported to control by about 80 to 90 percent as compared to previous years, (b) Silt clearance activities have been carried out by many FOs on self help basis, (c) A large number of disputes cases (146) mainly related to warabandi (water turn) were resolved by FOs, (d) Progress on crops assessment for the collection of water charges was about 70 percent in the respective canal commands.

While recently the results of a second round of performance evaluation, for the same first batch of 20 FOs, after completion of their one year functioning, shows the performance ranking in terms of FO success (PIDA, 2006). The results reveal that out of a total 20 FOs evaluated by the monitoring and evaluation cell of PIDA, nine (45%) were functioning ‘successfully’ followed by ‘adequate’ and ‘poor performer’ FOs counted as six (30%) and five (25%), respectively. Unfortunately, none of the 20 FOs was reported to perform well, as ‘good’. The key performance indicators and the criteria used for the evaluation of FO performance is presented in Annex Tables 2 and 3, respectively.

DISCUSSIONS AND CONCLUSIONS

The on-going reform process in the irrigation sector of Pakistan, which came in to existence after a long policy negotiation process, initially suggested by the international aid agencies and later adopted by the policy makers, has taken off successfully and on its way. However, the anticipated changes yet are not adequate enough to address the key issues faced by the irrigation sector of the country. Will the on-going reforms and transition process, when completed after 15 years or so, be successful? If yes, to what extent it will solve the issues of deficient irrigation management and services; and if not, then what is next? Would the existing PID staff be able to transfer successfully the management to the farmers and would the farmers be trained sufficiently to manage the system independently? These are such common questions and perceptions, which are moving around since the negotiation round of the reform process started in 1993 and even existing today in the minds of all stakeholders, including reform managers, water experts, policy makers and most importantly the common man, particularly a small illiterate poor farmer. The irrigation reforms proposed by the World Bank in Pakistan pointed out by Dinar et al. (1998) if implemented fully, would significantly affect the existing economic interests and power relationships in the irrigation sector.

Since its inception there are varying reactions and objections to the reform in different agencies and organizations, and there is not a consensus yet among the organizations and stakeholders (Nakashima, 1998). The performance level of the reform process is yet unclear and pace is very slow, while there are number of factors that seems influencing the performance of the reform process with the doubt of making it unsustainable. These factors include; the opposition from stakeholders themselves, changes in leadership, influence of personalities, lack of political commitment, lack of consistency & continuity and the change in the strategy and implementation model (Sarwar, 2006). A strong institutional and political economy constraint in view of Ali (2005) is the major cause of lack of progress of institutional reforms in the country. Controversies regarding fixing and collecting water charges, farmers' participation in a water users organization, delegation of farmers' authority to the PIDA and the process of transformation of PID in to PIDA are difficult issues to find agreeable answers to all parties concerned.

There were two primary institutional policy initiatives behind the irrigation reforms in the province of the Punjab, viz., the transformation of PID into PIDA and the participation of farmers through FOs and AWBs (Velde and Tirmzi, 2004). Commenting upon the present situation of the developing institution of PIDA, Sarwar (2006) reveals that the transition of PID to PIDA and the reforms call for a change in the whole institutional framework (top-down approach) to be changed into a multi-tier institutional set-up with users' participation. PIDA is still not having its own Managing Director while the Secretary Irrigation and Power is holding both the positions. The number of total PIDA employees reported till December 2005 in the LCC (East) circle were 1846 with only 15 permanent staff transferred from PID while another 521 PID officials were temporarily attached to assist FO (Sarwar, 2006). The policy regarding the transformation of PID staff to PIDA is yet not clear, raising the questions about the criteria (merit or willingness or any other) being used or would be the basis for the transformation of such staff as well as the number of staff transferred over a specific period of time is also unknown. On the other hand, it is also important to consider the commitment and capacities of PID staff (who will be PIDA staff) to contribute to the success of reform process. Another point of view discussed by Ali (2005) on the fear of the PID staff reveals that the engineers and staff of the PID could be against these reforms, fearing they would entail dissolution of their service, and breakdown in existing rent relationships

Though, PIDA is the successor agency of PID but currently it's only following the institutional reforms part whereas the infrastructure investment component is mainly being conducted by PID yet. The organizational set-up of PIDA in the Punjab province is quite different from that of PID. PIDA is still in establishing phase where the different cells of PIDA, except the social mobilization cell started working from 2005. It is obvious that the reform process requires a series of actions and PIDA establishment would require time to input a number of functions, such as governance and strategic management, financial capacity building for revenue assessment and recovery, O&M functions, technical services and a host of water market learning curves to achieve steady reductions in transaction costs (Ali, 2005). Similarly, AWBs would be responsible for a number of functions and they need to operate as financially self-accounting entities, with sufficient technical capabilities to monitor water supplies and be able to provide technical support to FOs. In turn FO need to be strengthened and require major capacity building exercises since they will be responsible for collecting water charges for reaching volume based contractual agreement with AWBs for water supplies, for O&M of irrigation facilities, for resource mobilization and for dispute resolution (Ali, 2005).

The FOs are the basic unit of the reform process and their proper functioning and performance will lead to the successful reforms. At the initial stage of the transition these FOs are supposed to perform their functions with joint assistance of the PIDA officials and later will mange the system independently. Thus, in the on-going reforms, the performance of FOs has got critical importance which mostly depends upon their understanding of the system, their capacity to manage and the support provided by the government during the joint management phase or during the initial phase of the management transfer. Achieving equity in water distribution and level of Abiana (water charges) collection are considered as very important criteria for their evaluation.

Under the on-going reform process in the Punjab, though the performance of FOs is not so bad at this initial stage of the reform process but needs a serious commitment at both ends of the process; authorities/skillful professional managers who are going to transfer the system and the farmers who are new to take over the responsibility. However, the results show that farmers are still not on the driving seat and requires lot of assistance form the PID officials and particularly follow-up trainings through the well-trained social mobilization officers. On the other hand this performance is based on very basic indicators and needs to develop a comprehensive scale to evaluate the sustainable success over time. Also the present FO performance carried out by M&E ell of PIDA, reflects only one canal command area of the Punjab irrigation system, while 24 canal commands (accommodated into 18 AWBs) existing in the Punjab have quite diversified situation in terms of varying irrigation and agricultural issues, a variety of socio-political conditions and a large variation in landholding/distribution situation that would probably effect much to the reform process and FO performance. So the adoption of same model for all canal commands, may not work successfully, as also mentioned in the World Bank (2005) that the Punjab has developed a “Punjab model” which is consistent with the spirit and logic of the on-going reforms but is adapted to the varying conditions to the province. Thus, the sustainability of the reform process, in general, and of the FOs, in particular, would be very challenging, which would decide the sustainability of the irrigation system and the irrigated agriculture in the province.

CONCLUSIONS

The continuous deteriorating performance of the irrigation system (coupled with the excessive use/exploitation of the groundwater resources) in the Indus Basin in general and province of the Punjab, in particular, is a big challenge for an agriculture-based country, like Pakistan. The emerging problems coupled with controversial issues regarding the on-going reforms are not only making the irrigation performance poorer but also slowing down the pace of the reform process. The opposition by the existing PID staff joint with the lack of commitment is the main cause of slow pace of the reforms. Irrespective of the uneven and slow progress with the reforms program, there is no alternative but to continue with the process and improve by drawing on lessons learnt, experience gained and coming to a better understanding on more effective implementation of the process. This is a big challenge and needs the strong commitment of all the stakeholders, devoted leadership and collective actions of the farming community under existing socio-political and environmental realities of Pakistani system.

In terms of the institutions, the PID is very important who are going to transformed in to PIDA, so the successful PIDA set-up and functioning depends upon a smooth and transparent transition process of the assets and human resources to this new organization. In-turn the transfer of technical and managerial skills from authorities (PIDA and AWB) as well as their committed attitude to enhance the capacities of the community and strengthen FO will lead to sustainable FO managed irrigation system.

On the other hand FOs who are going to take over the management system are the key player of the whole process. Therefore the future challenges for these FOs is not only to best manage the system (available water resources) and O&M of the system but also to best utilize the available water resources for increasing crop productivity. So in future ideally these would be the farmers (through FOs) who will decide what to grow (crop diversification) to increase crop and water productivity considering the growing population and increasing multi-sectoral use of the available water resources. The future sustainable FOs will not only manage surface but also the conjunctive water use rationally/productively for crop production (to grow crops with less water avoiding groundwater exploitation and maintaining water distribution equity of surface water). A strong commitment is needed on the part of those who are going to transfer the system (authority) to the hands of illiterate rural farmers that require intensive capacity building exercises. Since it has almost a decade passed, the reform process started, there is also a need to evaluate the performance of the on-going process at all levels of transformation (PIDA, AWB, FOs, other stakeholders), not only by the PIDA Monitoring and Evaluation Cell internally but also by the third party, including government representatives, consultants and research organizations.

ANNEXURES

Table 1. Scheme for Transfer of Irrigation Management in the Punjab Province

Implementation Schedule/Activity	Time Period
Establishment of PIDA	1997
Establishment of Pilot AWB	2000
Formation of KPs, NPs and FOs and Partial Management Transfer (PMT) to Ist Batch of 20 FOs	March 2005
Formation of KPs, NPs and FOs and PMT to 2nd Batch of 49 FOs	June 2005
Formation of KPs, NPs and FOs and PMT to 2nd Batch of 16 FOs	December 2005
Operationalization of FOs and AWB	NK
Testing of Functioning of FOs and AWB	NK
Continuation of Joint/partial management till complete Irrigation Management Transfer	NK
Continuation of capacity building/trainings/institutional support to FOs for their smooth and efficient operation	NK
Autonomous Pilot AWB	December 2008
Establishment of 05 AWBs of Ist Batch	2009 – 2013
Establishment of 05 AWBs of 2nd Batch	2014 – 2018
Establishment of 08 AWBs of 3rd Batch	2019 – 2023
PIDA as an autonomous entity	2024 – 2025

Source: Unpublished PIDA Report (2004) and PIDA (2006)

Table 2. Key Performance Indicators used for Evaluating FO Performance

Indicator	Weight/Score
Organizational development	15
Management of physical conditions of distributary	20
Irrigation service delivery	10
Regulation and equity in water delivery	20
Monitoring and water accounting	15
Dispute resolution & disposal of revenue cases	05
Water charges assessment and collection	15
Total Score	100

Source: PIDA 2006

Table 3. Success Criteria used for Evaluating FO Performance

Citeria	Description	Marks Rating
Poor	FOs not performing well and requires further support	Less than 50
Adequate	Minimum acceptable level and required performance monitoring	50 – 65
Satisfactory	FOs performing well and considered to be sustainable	65 – 85
Good	FOs performance is very good and fully sustainable	More than 85

Source: PIDA 2006

REFERENCES

1. Ali, I. 2005. Political Economy of Water Reforms in Pakistan, Background paper for the World Bank Report, Pakistan,s Economy Running Dry, March 2005.
2. Dinar, A., Trichur, K. B. and Wambia, J. 2004. Politics of institutional reforms in the water and drainage sector of Pakistan, Environment and Development Economics 9: 409—445 Cambridge University Press.
3. Nakashima, M., 1998. Pakistan's Institutional Reform of Irrigation Management: Initial Conditions and Issues for the reform
4. PIDA, 2004. Status report (unpublished)
5. PIDA, 2005a. Scheme for transferof irrigation management, Farmers Organization in Punjab. April 2005. PIDA, Lahore.
6. PIDA, 2005b. Monitoring and Evaluation Plan for the Performance of Farmers Organizations. August 2005. PIDA, Lahore.
7. PIDA, 2006. Irrigation reforms in Punjab: The implementation experience and performance evaluation. A presentation delivered at Ninth International Seminar on Participatory Irrigation Management held at Lahore, 4—8 December 2006 (unpublished)
8. Quershi, M.A. and Haq, A. U. 2006. Irrigation reforms in Punjab: The implementation experience and performance evaluation. A workshop paper to be published in the proceedings of Ninth International Seminar on Participatory Irrigation Management held at Lahore, 4—8 December 2006 (unpublished)
9. Rinaudo, J. D. and Tahir, Z. 1999. The political economy of institutional reforms in Pakistan irrigation sector. IWMI Working paper No. WP 99—02.
10. Sarwar, S. 2006. On the road to irrigation reforms: From PID to PIDA. A review of the irrigation management organizations in Punjab, Pakistan. A thesis submitted for the fulfillment of masters in land and water management, March 2006. Wageningen Agriculture University, The Neitherlands.

11. Velde, V. E. J. and Tirmizi, J. (2004) Irrigation policy reforms in Pakistan: who's getting the process right? In: Mollinga P. and A. Bolding (eds.) The Politics of Irrigation Reform. Ashgate Publishing, pp. 207-239
12. World Bank. 2005. Pakistan's economy running dry. http:www.worldbank.org.pk

PARTICIPATORY IRRIGATION MANAGEMENTS IN KERALA (INDIA) – REVIEW

Paimpillil Sebastian Joseph[1] and S. Thomas

ABSTRACT

The benefits from irrigation projects in India are not in proportion to the investment on them and steps were taken to bring down the expenditure. Attempts were initiated for participatory Irrigation Management to increase farmers' direct involvement in irrigation management, which ultimately results in the transfer of authority and responsibilities from the government, either in full or in part, to farmer organizations. Under a pilot study, one branch canal each of Neyyar (Olathanni) and Malampuzha (Kuthannur) projects were taken up with the objectives: to learn from the experiences on a small-scale manageable irrigation system by implementing, monitoring and learning; to help in testing the appropriateness of various PIM elements to local conditions; to demonstrate the possibility of PIM in Kerala; and to evolve a practicable and replicable strategy for the implementation in all irrigation projects of Kerala state. The pilot projects were being implemented by handing over the control and management of the two branch canals to the farmers. The projects encouraged collective farming, ensured the involvement of women in irrigated cultivation, promoted cooperation with panchayats, departments and other agencies and linked the farmers to the marketing sector. As the government had transferred some responsibilities of Irrigation Management from government agencies to Water Users Associations (WUAs), the villagers including farmers participated in the maintenance of the water management structures with a sense of ownership. The functions of these associations such as the acquisition and distribution of water, maintenance and repairs, fixation and collection of water charges, punishing defaulters within the areas of the WUA and resolving disputes among water users in the area of operation seemed to be an effective strategy for ensuring farmer/users participation in management of water for irrigated agriculture.

INTRODUCTION

Optimal utilization of the water resources through appropriate conservation and management measures assumes critical importance in sustaining the life support systems. The demand for water in Kerala (India) is mainly for domestic, agriculture, prevention of salt water intrusion, and generation of electricity. The annual yield of water in Kerala state in a normal year is around 7030 crore cubic meters and the ground

1- Senior Researcher; Center for Earth Research and Environment Management; Tel: 00914842203035; Fax: 00914842390618; E-mail Address: paimjose@sify.com

water resource available is estimated at 7048 MCM. The utilizable water resources is around 4200 crore cubic meters. Nearly 40 % of the available resources are lost as run off causing heavy floods. Kerala would require around 3000 crore cubic meters of water for agriculture, 750 crore cubic meters for domestic use and 1220 crore cubic meters for prevention of salt water intrusion. The pattern of demand for water is undergoing gradual but continuous changes towards increasing pressure for drinking and other household and commercial needs relative to the demand for irrigation.

Since the dawn of Indian Independence, the importance of water resources development in India was accorded due recognition and massive irrigation projects were created. Keeping in line with the national pattern and on the lines of earlier projects for rice growing areas, Kerala also relied on the development of major and medium irrigation projects. In each Five Year Plan, priority in resource allocation was given for the development of major and medium irrigation projects. Out of Rs. 2997 crore invested so far, major and medium irrigation projects account for Rs. 2072 crore, utilizing 69 per cent of the total. But such huge investment has not succeeded in generating commensurate increase in the area irrigated or in productivity or in returns. Even in the case of rice crop, the incremental yield, which the irrigation support could bring, is not significant.

The average annual potential in different rivers of India is estimated at 1,880 km^3 (Table 1). India has a large number of major rivers well distributed over the entire area. The average annual potential in different rivers of India is estimated at 1,880 km3 (Table 1).

Table 1. Water Resources Potential in the River Basins of India

Name of the River Basin	Average Annual Potential in the River (km3)	Percent Expected Storage to Average Annual Flow
Indus (up to border)	73.31	23
a) Ganga	525.02	16
b) Brahmaputra and others	597.04	11
Godavari	118.98	35
Krishna	67.79	5
Cauvery	21.36	38
Pennar	6.86	40
East flowing rivers between Mahanadi and Pennar	16.95	17
Brahamani and Baitami	36.23	48
Subernarekha	10.79	30
Sabarmati	4.08	41
Mahi	11.83	47
West flowing rivers of Kutch		52
including Luni	15.10	
Narbada	41.27	52
Tapi	18.39	77
West flowing rivers from Tapi to Tadri	109.01	12
West flowing rivers from Tadri to Kanyakumari	89.84	13
Area of inland drainage in Rajasthan desert - -	-	-
Minor river basins draining to Bangladesh and Myanmar	31.00	-
Total	1,879.45	20

Source: Gupta, *et al*., 2000.

The per capita availability of water per year in India is abysmally low (2,200 m^3). India is endowed with 4 percent of world's water wealth but the manifold demands imposed by the exploding demographic pressure may further reduce the per capita availability by 50 percent in 2025. The Water Resource Commission (WRC) estimated that the water requirement for agriculture sector will be two-fold and for other sectors such as domestic and industries seven-fold in 2025 at the current rate of water use. This will make agriculture a more precarious enterprise and necessitate a comprehensive planning for irrigation in India. The prime requisite for efficient use of water resource is to conserve it and to make it available at the site of use. But the optimum benefits from irrigation water are seldom realized. Only 20-40 percent of the irrigation water released from the reservoir is effectively used for crop production. The yield of food grains under irrigation is only 2.5 mt/ha as against the potential of 4.5 mt/ha. The potential created in the country increased from 26.26 million ha in 1956 to 89.44 million ha in 1997, with the gaps between the potential created and that utilized increasing from 1.22 million ha in 1956 to 8.75 million ha in 1997 (Gupta et. Al, 2000). Hence there is an urgent need to improve the system performance through efforts like Participatory Irrigation Management (PIM).

IRRIGATION AND WATER RESOURCES MANAGEMENT

Even though minor irrigation schemes are best suited for irrigation in Kerala, adequate priority was not given the allocation of resources, or in technical studies or in the study of economics of such projects. The government had formulated a Community Irrigation Project to develop ground water resources in Thrissur District with the active participation of the beneficiary communities. Through this project 131 bore wells have been drilled. The progress of implementation of the National Hydrology Project is slow and the physical achievement so far include installation of ten river gauge stations, nine new meteorological stations, four first grade laboratories and one second grade laboratory. The project will be completed in 2008.

Table 2. Status of Major Irrigation Projects

Status of Major irrigation Projects					
Completed Projects		Ongoing Projects		Projects under Investigation	
Sl. No.	Name of Project	Sl. No.	Name of Project	Sl. No.	Name of Project
1	Malampuzha	1	Kallada	1	Vamanapuram
2	Mangalam	2	Muvattupuzha	2	Chaliyar
3	Peechi	3	Idamalayar	3	Meenachil
4	Vazhani	4	Karapuzha	4	Aralam
5	Pothundi	5	Kuriyarkutty Karappara	5	Palakappandi
6	Gayathri	6	Chamravattom B/R	6	Payaswini
7	Cheerakuzhy	7	Thrithala B/R	7	Munnamkadavu
8	Walayar	8	Attappady	8	Project in Kabini Basin
9	Chalakudy	9	Banasurasagar		
10	Neyyar				
11	Pamba				
12	Periyarvalley				
13	Chitturpuzha				
14	Kuttiyady				
15	Chimmoni				
16	Kanakkankadavu B/R				
17	Pazhassi				

The state government had envisaged in the eleventh Plan, a strategy for water resources development and utilization for irrigation and other purposes, recognizing water as a scarce economic resource as well as common property and ensuring its utilization and management with utmost care and prudence. The key elements of this strategy are: Ongoing projects taken up years ago would be completed during the plan period, Revamping of 1st and 2nd generation irrigation projects would be taken up to improve the current level of utilization by taking into account the changes that have taken place over time and bringing about necessary modifications. This will be done in partnership with local governments and user groups.

Table 3. Ongoing Major Irrigation Projects

Name of Project	Starting year	Original estimate (Rs. crores)	Revised Estimate as per 1999 schedule of rates (Rs. crores)	Scheduled year of completion	Expected cost* (Rs. crores)
Muvattupuzha	1974	20.86	515.00	2003-04	581.47
Karappuzha	1975	7.60	253.00	2004-05	234.43
Thrithala	1998	19.00	26.60	2004-05	19.46
Chamravattom	1985	13.27	120.00	2004-05	9.99**
Banasura sagar	1979	8.00	50.00	2004-05	59.26
Idamalayar	1981	17.85	412.00	2007	254.31

The Farmers' participation would be introduced in a big way. For all new local irrigation schemes, beneficiary contribution to the tune of 15 per cent of the capital cost would be insisted on. The entire operation and maintenance would be handed over to water users' groups formed for the purpose. Local level Water Resources Development and Management through participatory approach is given thrust during the 11th Plan with a view to attain sustainable local self sufficiency regarding water requirements including irrigation requirement of the area. Participatory Irrigation Management is an attempt to increase farmers' direct involvement in irrigation management, which ultimately results in the transfer of authority and responsibilities from the government, either in full or in part, to farmer organizations. Under this study, one branch canal each of Neyyar (Olathanni) and Malampuzha (Kuthannur) projects are taken up with the objectives: to learn from the experiences on a small-scale manageable irrigation system by implementing, monitoring and learning; to help in testing the appropriateness of various PIM elements to local conditions; to demonstrate the possibility of PIM in Kerala; and to evolve a practicable and replicable strategy for the implementation in all irrigation projects of Kerala. An evaluation of the participatory irrigation management done on a pilot basis in the management of the Olathanni branch canal of Neyyar and the Kuthannoor branch canal of Malampuzha to the farmers had shown that these projects had encouraged collective farming, ensured the involvement of women in irrigated cultivation, promoted cooperation with panchayats, departments and other agencies and linked the farmers to the marketing sector. The benefits from participation irrigation projects were in proportion to the investment on them because of the short time taken for their completion. The legal, social and technical situation prevailing in the State for implementing irrigation management with the farmers' participation in the irrigation projects of the State is highly encouraging to give shape to a suitable system for it. Two proposed Participatory irrigation management schemes in Kerala are the Palakapandi and Meenachil river valley schemes in Palakkad district.

In the minor irrigation sector, the ‘the transfer’ is full, and in the major/medium irrigation systems, with the state responsible for more tasks at higher levels of the system (main system), and farmer organizations responsible for more at lower levels (branch canal/ distributory level). Efforts to bring transfer of management and PIM are often initiated by governments because of shortage of funds to maintain and manage the irrigation systems, inability to collect the water charges from farmers and poor record management performance. Command Area Development Authority (CADA) in Kerala has formed about 4,000 outlet-based farmer associations in the completed irrigation commands, in addition to several canal committees, and project committees. The PIM implementation agency will at the apex level organization. Opportunity for women involvement is given through inducting spouses of landowners in the farmer organizations. The recently enacted irrigation law has given legal sanctity for PIM in Kerala.

PARTICIPATORY IRRIGATION MANAGEMENT / IRRIGATION MANAGEMENT TRANSFER (IMT)

There is a lot that is wrong with the way government irrigation systems are run in India. Their actual commands fall far short of design commands; the quality of irrigation service on offer is often hopeless; the maintenance and repair of the head-works and canal systems are poor. Worst aspect is that their users have little role in the management of the system and therefore have no stake in its upkeep. Irrigation fees charged are a small fraction of the amounts farmers commonly pay for pump irrigation; and the fees actually collected are a small fraction of those charged. Clearly, at this rate, India will soon face erosion of a huge irrigation capital it built at a massive investment. What might be the approaches to reversing this invidious trend? The dominant answer, it is widely claimed, is involving farmers in managing their irrigation systems either through Participatory Irrigation Management (PIM) or Irrigation Management Transfer (IMT). The Canal irrigation system experts (Manas Dasgupta, 2004) have found most of the existing projects in the country faulty in design and maintenance, leading to the deprivation of farmers, particularly in the tail-end. They have recommended a system managed by farmers' organizations to remedy the situation.

The present system of water management in the country does not provide for collective efforts in self-governance by the users. In most irrigation projects, farmers' involvement is lukewarm. Traditionally the role of water users in operation and maintenance (O&M) of irrigation sources has been informal and community based. It is an informal farmers group with one or two organizers. This group controls the organization and collects nominal fee from farmers fixed by collective decision. Water masters work in small areas of about 40 ha and distribute water among different water outlets after receiving from the Public Works Department [PWD]. Irrigators irrigate the field and the area of operation per irrigator is about five ha for double crop wetlands and about 10 ha for single crop wetlands.

Bringing farmers into group action and involving them in planning of water management strategy, accommodating all their genuine needs will make them work voluntarily for the success of the system. PIM is ' for the farmers', ' by the farmers' and 'with the farmer's. Participatory Irrigation Management (PIM) is advocated as a new paradigm for efficient irrigation of irrigation system of the country. The PIM in general refers to involvement of farmers in all aspect of management of irrigation system such as planning and development of the system, Operation and Maintenance (O&M), collection of water charges, allocation of water, resolution of conflicts etc Farmers, who are the main stakeholders of the irrigation system, were found to have stronger inclination to manage the irrigation system most efficiently, once the same are legally transferred to their associations. For obtaining optimum benefits from the existing irrigation projects, all beneficiaries under it should actively participate in decision making process of water utilization, maintenance and management.

FORMAL WATER USERS' ASSOCIATION (WUA)

Despite the recognition of the importance of farmers' participation in irrigation management by the National Water Policy of 1987 and the Committee on Pricing of Irrigation Water-1992, (INCID, 2000), the progress in this direction has been tardy. The Water Users' Association (WUA) is a three-tier system of water monitoring organization. The unit for the association is one sluice (command) area and all the landowners in the area will be the members of this association and they will elect the executive committee and the office bearers. The second tier, the farmers' council (FC) comprises an irrigation division, the area of which may vary from 1,000 ha to 2,000 ha. The President and General Secretary of the farmers' association will be the ex-officio members of this council, which will have office bearers elected by the general body. The management of the irrigation division will vest with the FC. The third tier, which is an apex body, is the farmers' federation. The general body elects the executive committee; the President and General Secretary of the FC shall be ex-officio members. This federation shall also have an advisory council. The main functions and responsibilities of the WUAs are: To monitor, regulate and distribute the irrigation water on an equitable basis among the farmers in the sluice; To maintain on-farm development (OFD) structures constructed below the outlet point; and To solve the irrigation disputes or problems that may arise from time to time.

It is estimated that only 862,563 ha are being managed by WUAs in the various Indian States, accounting for only 1.62 percent of the total irrigated area (Palanisami and Paramasivam, 2000). Table 4 provides an overview of the extent and performance of WUAs in a few selected States of India.

Table 4. State wise number of water users associations and area covered by them

Sl. No	Name of State	Number of WUAs	Hydraulic level at which formed	Approximate area covered ("000 ha)
1.	A.P.	10292	Minor	4800.00
2.	Assam	17	Minor	6.00
3.	Bihar	1	Distributary	12.20
4.	Goa	42	Minor	5.00
5.	Gujarat	476	Minor & LIS	19.00
6	Haryana	2575	Outlet	200.00
7	H.P.	875	Minor schemes	35.00
8	J&K	1	Minor	1.00
9	Karnataka	760	Minor	138.38
10	Kerala	3930	Outlet	148.48
11	M.P.	1470	Minor	1495.00
12	Maharashtra	247	Minor	91.62
13	Manipur	62	Minor	49.27
14	Orissa	164	Minor	73.75
15	Rajasthan	417	Minor	185.67
16	Tamil Nadu	7725	Minor	474.28
17	U.P.	1	Minor	1.00
18	West Bengal	10000	Tube wells	37.00
	Total	39055		7772.65

Although the role of women in cultivation has long been accepted and documented, it has never been extended to irrigation and irrigation management. The prevalent belief is that irrigation is not a woman's domain. The government's National Water Policy (1987) recommended farmer participation in irrigation management as a strategy to bring about structural reform. In Gujarat, the implementation of the National Water Policy guidelines was initiated on an experimental basis in the district of Bharuch. The results proved so encouraging that in 1995 the state government declared a policy on Participatory Irrigation Management (PIM), along the lines of the national policy, encouraging farmer participation in the planning, implementation and management of direct and indirect irrigation projects, and seeking the co-operation of voluntary organizations. Participatory irrigation Management refers to programmes that seek to increase farmers' direct involvement in irrigation system management - either as a substitute or complement for the state role. This generally leads to some form of joint management or co-management of irrigation systems with the state responsible for more tasks at higher levels of the system and farmers organizations responsible for tasks at lower levels.

In Bharuch district, PIM has been initiated (Advaita Marathe, 2003) with support from the Aga Khan Rural Support Programme (India), a non-communal, non-profit rural development organization with a focus on natural resource management. The core concern of AKRSP (I) is organizing communities and building their capacity to manage their resources. The organization encourages the participation of women in its programmes. When AKRSP (I) first undertook the PIM projects on a pilot basis, not much attention was paid to the involvement of women in managing irrigation systems. This was chiefly because the role played by women in irrigation and the productive use of water is virtually invisible. However, growing awareness within the organization led to conscious efforts to involve women in the canal irrigation management societies and to change the perception that women could not handle matters of irrigation, or were not concerned with it.

Women were involved as nominal members only; only landowners were made regular members. As nominal members, they had no say in the decision-making. Slowly, however, following the organization’s proactive efforts at involving women in the CIS and management committees, people began to be convinced that involving women would bring about overall development within the village community. In fact, their involvement is now visible in every aspect of PIM, whether it is motivating farmers groups, overseeing canal construction, repair and maintenance, committee decision-making, framing the rules for water distribution, setting the terms for irrigation, water distribution and administration, liaising with government agencies, etc. The only problem, as perceived by the women, is monitoring water distribution at night, as alcoholism is rampant in the region.

As a result of their involvement, the lives of these women have undergone a complete transformation. They are much more confident and have taken control of their lives, those of their families and also that of the community. Other notable changes are an increase in their knowledge base and increased mobility. Where earlier they did not venture outside the village, they now walk into any government office, interacting with government officials. Their tolerance of injustice has been considerably lowered, as is evident in their personal lives.

However, it's not as though the women's involvement has been accepted without protest. Many women faced, and continue to face, social disapproval and familial opposition. The myth that women have no role to play in irrigation management has been shattered, by the Gujarat and Kerala government's Participatory Irrigation Management Policy.

CONSTRAINTS TO PIM

A farmer will join and work with WUA, if they get water when they need it and the costs that he has to incur are lower than the benefit envisaged. The current water rate structure in public systems is cheaper than that of privately managed irrigation system. Profit from irrigated farms is only 2.25 times that from rain-fed farms and expenditure is two times higher. The net benefit per ha per farm works out to only Rs.476, which is too low an incentive to take to irrigation (Patil, 1994). The irrigation agency needs to supply water in adequate quantities during different growth phases of the crops. A volumetric pricing system or rationing of water and an incentive to farmers to efficient use of water are essential to encourage farmers to WUA. The misplaced apprehension is that the O&M costs besides increased water rates will have to be borne by them deter many farmers from taking to the system. But the reality is the phenomenon of underutilization or mismanagement of utilization. Farmers have no confidence that they will get water when they need and there is no penal measure, if water is not delivered on stipulated dates.

The management of real water managers in the field namely, farmers and the inter-relationships with the requirements and the distribution agencies are not recognized specifically to each irrigation projects. This arises because attention is usually concentrated on hydrological, engineering, agricultural and economic aspects in all the irrigation projects. Factors like size and homogeneity of group, the motivation of farmers and the conducive environment of the farmers are not taken into cognizance.

Another deterrent is the tail-ender's problem, wherein the fields of the farmer at the tail-ends within the potential localized areas do not receive water. In fact about 18-20 percent of the localized areas at the tail-ends do not receive irrigation water in most of the projects. The in-discipline of the users is also another causal factor for the malady of the system. The farmers in the upper reaches by virtue of their advantageous positions draw more water illicitly and convert irrigated dry areas into wet areas, depriving the legitimate share of the tail-end farmers. In order to irrigate the land in the shortest time possible, the farmers in their indiscretion cause damage to the sluices and effect breaches in canals.

The malady and failure of many WUAs is ascribable to lack of: (a) policy and legal support from the government; (b) authority and power to the WUAs; (c) financial support to the WUAs; and (d) cooperation and support from the irrigation agencies. The local governments do not accord necessary recognition for the existing WUAs for their autonomous functioning. The lack of an enabling law for the establishment of WUAs is also a major impediment in the introduction of PIM. There is need to have a separate legislation for the formation of WUAs.

FUTURE PROSPECTS OF PIM

Besides providing right amounts of water at right time and at right place, attaining high water efficiency requires that the crop yields be maximized with given amount of water by improved agronomic practices for high yields and thus elevate water use efficiency such as the emerging trend of less water demanding perennial crops in lieu of seasonal crops. Currently, the technology concerning optimal irrigation scheduling and agronomic practices for increasing water use efficiency of crops is dismally modest. The manageable area for effective and efficient functioning of the FC with active involvement of majority of farmers need to be limited to 500- 1,250 ha.

To encourage formation of WUAs, the government may usher in incentive policies such as priority for infrastructure modernization. The irrigation water may be provided only in bulk rather than to individual farmers, to motivate and organize farmers through the cadre of trained organizers.

There is a need for mass media support for effective diffusion of the technology. The multitudinous benefits of PIM should be disseminated through seminars, workshops, group discussions, wall posters, notices, leaflets, folders, debates, all propaganda etc. Moreover, multi-tier training to policy-makers, irrigation management functionaries and farmers should be organized.

CONCLUSION

Against the backdrop of diminishing water resources and mounting water scarcity, the concept and practice of PIM has assumed a critical role in irrigation management. WUA, an adjunct of PIM serves as the fountainhead of an assortment of benefits, but the establishment and functioning of WUAs is confronted with constraints. The WUAs would enjoy complete freedom of choice in following cropping pattern and WUAs would be empowered to decide water charges for their members and non-members. Impartial and in-depth analysis of these deterrents and implementation of appropriate strategies can make the practice of PIM more viable and vibrant. Will PIM or IMT salvage India's public irrigation systems? Or is there need to think of and experiment with alternative strategies of vitalizing this important sector?

REFERENCES

1. Advaita Marathe, 2003, Women’s participation in irrigation management reaps rewards in Gujarat, Info Change News & Features, July 2003
2. Gupta, S. K., P. S. Minhas, S. K. Sondhi, N. K. Tyagi and J. S. P. Yadav, 2000, Water
3. Resource Management, International Conference on Managing Natural Resources for
4. The 21st century, in J. S. P. Yadav and G. B. Singh (eds.) Proceedings Natural
5. Resource Management for Agricultural Production in India, 144, 14-18 February
6. 2000, New Delhi.
7. Manas Dasgupta, 2004, Study favours farmers' role in irrigation management, In Hindu National daily, 28 April 2004.
8. Palanisami and Paramasivam, 2000, Participatory Irrigation Management (PIM).
9. Lessons from WUAs for Tamil Nadu, WTC, TNAU, Coimbatore
10. INCID, 2000, India. Land and Water Resources at a Glance. INCID News, Vol. 7
11. (2): 2000.
12. Patil, R. K., 1994, Economics of Irrigated Agriculture and Its Implications for Farmer
13. Participation in Irrigation Management., in Farmers in the Management of Irrigation
14. Systems, 198-240, Ford Foundation, New Delhi.

"WE BUILD THE TANK AND THE TANK BUILDS US": THE ROLE OF SHRAMADANA IN PARTICIPATORY IRRIGATION MANAGEMENT IN SRI LANKA

Kalinga Tudor Silva[1]

The practice of shramadana is so widely defused in Sri Lanka nowadays that it is often used as a synonym for voluntary community action of any kind[2]. Not many people realize that it is indeed the Sarvodaya Movement led by Dr. A.T. Ariyaratne that introduced this development practice in Sri Lanka. While he emulated "Shramadan campaigns" by Mahatma Gandhi and his followers in India, the specific contribution of Dr. Ariyaratne lied in adapting it to the Sri Lankan context building it on certain customary self-help mechanisms firmly rooted in rural Sri Lanka. While shramadana is a new practice its long-term continuity and effectiveness have a lot to do with its affinities with customary labour sharing practices in paddy cultivation and irrigation systems that sustained paddy cultivation for many centuries. Dr. Ariyaratne developed shramadana as a central component of the Sarvodaya development strategy and demonstrated its relevance and applicability in community development in a wide variety of settings in Sri Lanka. The continued popularity of Shramadana in rural as well as urban Sri Lanka within and outside the Sarvodaya Shramadana Movement, so named because of the central importance of shramadana as a hallmark of this social movement that began as a campaign for involving school children and youth from the capital city in voluntary service in disadvantaged communities in rural Sri Lanka, in spite of many changes in the country over the past five decades must be seen as a major tribute to the ingenuity, adaptability as well as cultural rootedness of ideas and practices introduced by this pioneer development worker.

As understood in the Sarvodaya Movement in essence sharmadana involves collective mobilization of voluntary labour of a varying number of committed individuals towards building or renovating a tank, road, a well, a community hall or any such facility beneficial to the whole of a segment of a community. "Shramadana" literaily means "donation of labour" (shrama=labour, dana=giving, donation). Since "dana" (giving, donation) is a fundamental aspect of Buddhist moral code, participation in shramadana is understood not only as a communitarian act expressing one's dedication towards collective goals and concerns but also a meritorious act. Through contribution of one's own physical labour towards meeting a felt need in the community a person expresses one's community spirit, fellowship and dedication towards achieving collective goals.

1- Dean, Faculty of Arts and Professor of Sociology University of Peradeniya
2- An earlier version of this paper was presented in the Workshop on Self-Help Promotion in Sri Lanka organized by the GTZ working group on self-help promotion in Kandy, June 15-16, 1995.

As implied in the well known and highly evocative statement of Dr. A.T. Ariyaratne, “We build the tank and the tank builds us”, in the Sarvodaya Movement Shramadana is not just a means of mobilizing free labour for development of physical infrastructure but also a means of promoting community spirit and social harmony.

This paper seeks to trace the origin and development of shramadana in Sri Lanka, its continuity and, at the same time, discontinuity with traditional mutual help mechanisms in rural Sri Lanka and critically assess the significance of shramadana from the angles of participatory development in general and participatory irrigation management in particular.

THE ORIGIN AND DEVELOPMENT OF SHRAMADANA

The campaigns by Gandhiji and its ideological heir the Sarvodaya movement of India organized “Shramadan” as a means of mobilizing voluntary labour for community service. Under the inspiration of Gandhian ideas and practices the Sarvodaya Movement of Sri Lanka, at its inception in 1958, took large groups of students from leading schools in Colombo and other cities to work side by side with local volunteers in “ Shramadana Camps” organized in poor and depressed villages in remote areas. The shramadana approach quickly spread to other organizations and programmes because of its mass appeal, utility as a community based strategy for getting some public works done and association with the ideals of social harmony, dignity of labour, mutual help, self reliance and “sacrifice of time and energy for the benefit of the poor and underprivileged”.

The Sarvodaya’s role in introducing Shramadana in Sri Lanka is acknowledged in Dr. Ariyaratne’s writings.

> “The Shramadana concept was introduced to this country by the Sarvodaya Shramadana workers of Sri Lanka with the above perspective of removing social and economic injustices, ensuring increased economic growth, freeing society of all forms of exploitation of man by man, establishing an ed1quitable distribution system of goods and services, liberating the human being so that he may be able to participate in decision making as a person and a subject in such a development process in which he is the master and not the slave” (Ariyaratne 1980b: 42).

While admitting its pioneering role in diffusion of Shramadana in Sri Lanka, Sarvodaya clearly acknowledges that the practice is firmly grounded in local culture.

> “The Sarvodaya concept and Shramadana action are a living philosophy and a concrete practical programme with which the people are already familiar by their cultural conditioning and traditional co-operative way of living” (Ariyaratne 1980b: 42).

> “The most outstanding contribution that the Movement has made to the social development of Sri Lanka, in my opinion, is the re-introduction of the technique of Shramadana, or the mutual sharing of labour, which in the pre-colonial days was an essential aspect of the cooperative way of life of our people. The Movement built on this heritage when it organized camps throughout the rural areas, providing an opportunity for people to think, plan and work together, and then evaluate their efforts. In other words, Shramadana was not just a labour

> camp, where a useful physical objective was to be achieved. It was a revolutionary technique, to awaken people to their own potential based on their own culture and innovative abilities" (Ariyaratne 1980a: 26-27).

Thus the Sarvodaya movement became synonymous with Shramadana in its formative period.

HOW FAR IS SHRAMADANA CULTURALLY GROUNDED?

As noted earlier, the Sarvodaya Movement argued that shramadana merely represents an extension of a co-operative cultural practice already well established in Sri Lanka. Dr. Ariyaratne expressed this view as follows:

> "Paddy agriculture practised by the Sinhala people is an excellent example of the application of the concept of sharing…. Priority was given to the construction of tanks and irrigation systems…. All stages of paddy farming such as ploughing, sowing, weeding, manuring, harvesting and threshing were done on the principle of shared labour. This form of sharing of labour by all was called 'samudan' by the ancient Sinhala. 'Samu' means collection of people and Dana means sharing. Later it was called Kayya. In 1958 our movement introduced the word 'Shramadana'." (Ariyaratne 1980a: 52).

In order to understand its continuity with and distinction from preexisting cultural practices, we compare shramadana with four customary mechanisms whereby collective labour was routinely mobilized for various purposes, namely rajakariya, kayya, attam and nikam.

RAJAKARIYA

Under rajakariya (lit" service to the king") each person was required to pay certain periodic dues and provide periodic service towards maintenance of state machinery, public works, including irrigation works, and religious institutions. This practice became highly elaborate during the Kandyan period (1500-1815), but following the overthrow of the Kandyan kingdom by the British rajakariya wad gradually abolished as an instrument of the state. Some categories of peasants held land subject to fulfillment of rajakaruya services which typically took the form of fulfilling caste obligations. Other rajakariya duties such as participation in warfare, clearing of irrigation canals and road work were stipulated for all citizens for a fixed number of days assigned by the local officials (Pieris 1956). Rajakariya was by its very nature compulsory and obligatory. In contrast, one's participation in shramadana is expected to be a purely voluntary activity. Unlike shramadana which is responsive to situational needs identified locally, rajakariya services were fixed and standardized, e.g. Five person days per year per family cultivating an acre of irrigated paddy land for renovating the bund of the local tank.

KAYYA

There was some variation in the practice of kayya in different regions of Sri Lanka. However, under the kayya system like in rajakariya the peasants typically provided free labour to a community. Kayya differed from rajakariya in that participation in kayya was voluntary rather compulsory and that the recipient of labour typically treated the workers with food and snacks. From the angle of the peasants the main objective of a kayya was to fulfill obligations to a community leader. The idea of mobilizing collective labour for the purpose of fulfilling a felt need in the whole community as in modern shramadana was foreign to the practice of kayya.

ATTAM

The reciprocal exchange of labour among peasants typically in various stages of rice cultivation is known as the attam system. Each unit of labour received from an attam partner must be reciprocated by the recipient or some one nominated by him within the same crop season typically in the same farming activity. When necessary the attam system enabled the peasants to recruit a work gang bigger than the one available within one's own household. Gunasinghe (1976) found that while the attam system operated on the basis of some social norms, economic calculations too influenced the choice of attam partners, their number and the farming activities in which attam labour was used.

NIKAM

In contrast to attam which involved a form of contractual reciprocity, donation of labour for the benefit of a kinsmen, neighbor of a friend specially at a time of distress like sickness, death or a natural calamity was called nikam (i.e. free of charge or obligation). As Robinson (1975) elaborated this form of non-reciprocal labour was based on social obligations towards known persons within one's own community. Under this system there was no immediate obligation of the part of the recipient of labour to reciprocate the help received from others. This was a social mechanism that enabled and odd family in di8strss in a community to carry of out their subsistence activities in spite of any special hardship it encountered.

The shramadana system has some affinity with these traditional forms of labour mobilization in rural Sri Lanka. It builds on the notions of mutual help evident in nikam, attam and, to a lesser extent, kayya. It mobilizes gangs of rural labour for the maintenance and upgrading of public works somewhat in the style of rajakariya even though the element of compulsion and legal enforcement intrinsic to rajakariya is entirely foreign to the idea of shramadana. Shramadana is conceptualized as a "donation of labour" somewhat in the style of nikam even though in shramadana one's labour is 'donated" for fulfilling a collective goal rather than helping and persons or individuals in distress.

The practice of shramadana however differs from the traditional systems of labour mobilization in the following ways.

01. In shramadana collective labour is mobilized entirely on a voluntary basis. The practice of shramadana does not rest on either legal sanctions or any informal community sanctions against those not participating in a shramadana.
02. Shramadana labour is mobilized purely for the purpose of fulfilling a community need rather than a private need of any individuals. In this respect shramadana differs from kayya where the beneficiary is a respected community leader and nikam where the beneficiary may be someone in distress of some kind and, therefore, warrants help by others on sympathetic grounds.
03. In shramadana as will be elaborated later economic calculations like number of labour units needed for building a road of a certain length, for instance, or relative cost of building a road with light machinery as against use of manual labour is typically not done as a part of the project design.

In contrast, some of the traditional forms of mobilization of labour such as attam and even rajakariya were based on a clear conception of the number of labour units needed for accomplishing particular task.

In summary, while shramadana is guided mainly by a presumed cultural logic of selfless sacrifice of labour for the benefit of community as a whole and the poorer sections of the community in particular, the traditional cultural practices in labour mobilization involved a greater degree of economic calculation of labour time and of direct or indirect returns from labour.

SHRAMADANA AS A DEVELOPMENT TOOL

Here we discuss two instances where shramadana concept has been mobilized on a large scale in recent development activities in Sri Lanka. As noted earlier the Sarvodaya Movement not only introduced this form of labour mobilization in Sri Lanka but also played a leading role in popularizing it as a developmental practice. Second we will discuss the use of shramadana as a part of the Janasaviya programme conducted by the state from 1989 to 1994.

In the Sarvodaya Movement the normative, integrative and psychological functions of shramadana took precedence over any instrumental value attached to this form of labour mobilization.

> "The literal meaning of the word Shramadana is sharing of one's time, thought and energy for the **welfare of all.** For the founders of this Movement, Shramadana was only a medium of constructive action to bring about a **non-violent total revolution in man and society to build up a new social order."** (emphasis added) (Ariyaratne 1980b: 41).

In the Sarvodaya approach to development a shramadana campaign was typically the first step in mobilizing people in a village. A shramadana was seen as the beginning of a process leading to an "awakening" of individuals for their duties and responsibilities vis-à-vis the society at large and the resultant community mobilization for development. Through a shramadana effective functional leadership in a village was identified and mobilized for rural development. It was expected that a correctly organized shramadana would lead to further collective action and a lasting framework for self-help promotion and social development attuned to an indigenous cultural logic.

Sarvodaya Movement did not emphasize any economic rationale of mobilizing collective labour for infrastructural development in the countryside. Moreover, it was opposed to treating shramadana within a dominant economic logic.

> "The effectiveness of Shramadana is bound to be lost if this form of action is used only as **a money saving process** to realize **a physical objective.** In the recent past more damage than good has been done in many areas by some people, who knowingly or unknowingly, equated Shramadana to **some form of free labour movement.** They desired to create **non-monetized capital** to compensate for the serious lack of capital needed for national development … Shramadana to us has had a more profound meaning and significance. To us it is a positive force for the total liberation of man and society… The **bureaucratization of Shramadana,** we maintained, defeated the very object of founding the Shramadana Movement." (emphasis added) (Ariyaratne 1980b: 41).

While the Sarvodaya's approach to development had the effect of promoting cultural acceptance of shramadana integrating it with a harmonious model of social development, it lacked the pragmatism and economic rationality contained in most of the traditional methods of labour mobilization. On some special occasions it was not difficult to organize a shramadana based on the principle of **voluntary** gift of labour for **the welfare of all,** but such a principle could not provide the basis for a lasting arrangement for mobilization of sufficient labour for construction and routine maintenance of any infrastructural facilities. While interpersonal obligations of a contractual nature and a direct return for every labour unit offered to another party were involved in attam partnerships, in shramadana labour was realized in the form of an unquantified and abundant supply of free labour operating outside the market logic. Once labour was understood as a highest form of gift to be evaluated on the basis of its cultural worth and dedication towards collective goals, the economic value of labour in terms of its efficiency, productive capacity and output was likely to take a lesser significance. On the whole while the Sarvodaya's conception of shramadana made good cultural sense it did not always make good economic sense in so far as it rested on a principle of voluntary gift of labour for the welfare of all. Despite Sarvodaya's long–standing involvement in shramadana it is not possible to evaluate its contribution to permanent improvement in rural infrastructure and the productivity of shramadana labour vis-à-vis any alternative forms of labour mobilization.

Even though shramadana may not be the most efficient form of labour mobilization for all types of community needs, it may be argued that it involves a high level of community participation and promotes self reliance in the development process. One of Sarvodaya's major contributions towards social mobilization has been the active participation of large numbers of men and women in grass root level development activities and the training of a new generation of community leaders who are committed to the goals of participatory development. While in its early stage Sarvodaya relied heavily on the voluntary labour of school children and other motivated individuals from urban centers in projects conducted in the so-called depressed villages in remote parts of Sri Lanka using a somewhat paternalistic model of gift of labour form outside (shramadana "camps") as a catalyst for mobilizing the poor and underprivileged in rural communities, a more community- based approach to shramadana using a higher proportion of local volunteers evolved later. The widespread diffusion of shramadana to other organizations and programmes itself may be seen as a triumph of the participatory approach and an index of viability and sustainability of this technique outside the ideological parameters set by the Sarvodaya Movement.

The free labour mobilized under the Janasaviya programme in the name of shramadana was more compulsory rather than voluntary. The recipients of Janasaviya (consumption aid of the state accompanied by some help towards development of income earning activities) were required to provide a fixed quantity of free labour towards fulfillment of collectively identified urgent infrastructual needs such as rehabilitation of a local irrigation tank or improving road access to a remote part of the village (Mendis 1992). The voluntarism typically associated with Sarvodaya style shramadana activity was entirely absent in the Janasaviya programme. On the other hand the Janasaviya programme involved a fixed commitment of labour on the part of the beneficiaries of the programme somewhat in the style of rajakariya. While the Janasaviya programme recognized the economic value of labour more directly than the Sarvodaya programme, any state compulsion for provision of communal labour was likely to undermine self-help participatory principles contained in shramadana and its long-term viability as a spontaneous community response towards fulfilling urgent felt needs in the community.

SHRAMADANA AND PARTICIPATORY IRRIGATION MANAGEMENT

From the angle of participatory irrigation management, shramadana is useful for mobilizing voluntary labour for occasional repairs in village level irrigation tanks and related canal systems. Sarvodaya movement and many other grass root level development programmes have effectively utilized the shramadana strategy for renovating abandoned or neglected ancient irrigation works in remote dry zone and intermediate zone areas in Sri Lanka. Shramadana is also employed from time to time for clearing of canals in major irrigation systems such as Mahaweli and Gal Oya schemes. Given the economic as well as cultural and symbolic significance of irrigation tanks as collectively owned community resources in arid regions in Sri Lanka, mobilization of voluntary labour for this purpose has not been so difficult. However, it is different from customary rajakariya labour in that the obligation is neither enforced by the state nor proportional to the benefits derived by the workers from the irrigation systems. Where element of compulsion is used to extract shramadana labour its participatory qualities may suffer as often pointed out by the Sarvodaya Movement. While shramadana may be an effective means of mobilizing a large volume of unpaid voluntary labour in one off renovation efforts with corresponding broad based community involvement in the affair, shramadana may not be an efficient or reliable way of mobilizing labour for periodic maintenance work in a routine manner. This is particularly the case where the market economy has deeply penetrated into the countryside. Sustainable participatory irrigation management must rely on cost sharing mechanisms whereby there is no room for free riders and relevant community organizations can enforce routine contributions, including any contributions of labour, by beneficiaries of irrigation systems in keeping with the extent of land cultivated under the irrigation systems and benefits derived by them.

CONCLUSION

An active engagement and a compromise between social and economic goals of shramadana may be necessary if it is to be sustained as a viable development practice in keeping with the principles of participatory development. A greater sensitivity towards economizing labour and improving its productivity can improve the results of Sarvodaya style shramadana typically focusing on integrative social functions of shramadana rather than its efficiency towards achieving given economic outcomes. On the other hand, one sided concern with the fruits of free communal labour to the neglect of the process of social mobilization involved can lead to a situation where shramadana is equated with forced labour. Under such circumstances the so-called shramadana will be an obstacle to participatory development rather than a means to achieve it. More participatory forms of shramadana could be encouraged through external aid to local communication and a realistically valued component of shramadana labour may be treated as a local contribution in an externally funded programme of community development, inclusive of irrigation development. Economic and technical aid in such a programme may be designed in a way that integrates an estimated and regulated supply of voluntary shramadana labour from the direct beneficiaries when needed. Finally the productivity and efficiency of shramadana work must be evaluated on the basis of the standards decided by the local people themselves side by side with its significance for social mobilization of underserved communities in particular.

REFERENCES

1. Ariyaratne, A. T.

   1980a Collected Works: Vol 1. Colombo: Sarvodaya Research Institute.

   1980b Collected Works: Vol 1. Colombo: Sarvodaya Research Institute.

2. Gunasinghe, Newton

   1976 Social change and the disintegration of a traditional system of labour in Kandyan Sri Lanka. ciological Bulletin 25: 168-84.

3. Mendis, P.

   1992 The economics of poverty alleviation: the Janasaviya Programme in Sri Lanka. South Asia Journal 5 (3): 289-298.

4. Pieris, Ralph

   1956 Sinhalese social organization: the Kandyan period. Colombo: Ceylon University Press.

5. Robinson, M.

   1975 Political structure of a changing Sinhalese village. Cambridge: Cambridge University Press.

PRE-REQUISITES AND STRATEGIES IN ESTABLISHMENT OF WATER USERS ASSOCIATIONS (WUAs)

By: Mehdi Khalili Marandi[1], Ahmad Balan[2]

ABSTRACT

Crisis in freshwater resource and its scarcity has threatened sustainable development, environment, human safety and welfare in last decades, and called governments commitments for changes in approaches for establishment of participatory management on water and environment resources at all levels (Rio, 1992). Ninety two percent of available freshwater is currently used for agricultural production, and hence, participation of farmers in irrigation management and operation has been so far legislated and stressed in all National Development Plans. Organizing of farmers in community-based organizations plays important role in country's soil and water resources management. Instead of failure of governmental agencies in irrigation system operation and maintenance during last decades, suitable substitutions should be searched for reducing imposed burdens on government and for improved performance and management on water systems.

Three consultative workshops were held and participated by experienced managers and professionals to find the best formation for WUAs. Analytical Hierarchy Process (AHP) with Expert Choice Software was also applied whose results indicate that Guild Water Users Association (GWUAs) is legislatively the best organization to undertake operation and maintenance of irrigation system.

Irrigation Management Transfer initiative approved to be a real sample of farmer's participation in form of GWUAs in management and maintenance of irrigation system in Gazvin Plain. In this paper, challenges, opportunities, bottlenecks, achievements and weaknesses are discussed followed by certain remedial recommendations forwarded for improvement. Despite of rapid and complete establishment and good performance of GWUAs in irrigation management and maintenance of the network, however, lack of proper legislation and transparency in relation to governmental institutions would eventually induce many undesired conflicts and problems in future.

1- Mehdi Khalili Marandi, Ph.D. in Water Resource & Hydrology, Senior Expert, Bureau of CBOs Development, Assistant professor, Varamin Azad University, m.khalili.marandi@gmail.com, +9 89121380409, +982188923938
2- Ahmad Balan, M.A in Sociology, Deputy, Bureau of CBOs Development, Balan1338@yahoo.com

Keywords: Irrigation-Drainage System, Irrigation Management Transfer Initiative, Water Users Associations, Operation and Performance, Network Management and Maintenance.

FOREWORD:

Crisis in freshwater resource and its scarcity has threatened sustainable development, environment, human safety and welfare in last decades, and called governments commitments for changes in approaches for establishment of participatory management on water and environment resources at all levels (Rio, 1992). Need for a real participation of water users communities in irrigation management has explicitly been focused within the context of the2nd, 3rd and 4th National Development Plans. In fact, organization of real users' groups for sound utilization of water resources under well-structured organizations seems a crucial challenge whose success would seriously affect the national soil and water potentials. This paper grows up with: a brief description of general status of national water stocks; existing irrigation-drainage systems and their exploitation management; and the process undertaken for establishment and utilization of a sample community organization in a wide plain together with its modern irrigation-drainage networks and the challenges and opportunities that practitioners have so far encountered. At the end, there are certain key recommendations placed on critical issues for due discussion and investigation.

ALLOCATION OF HARVESTABLE WATER RESOURCES:

Consumption pattern of the total harvestable water shows an allocation of 8% for drinking and industrial purposes while the majority (92%) goes for agriculture sector. Regarding the establishment of relevant offices for water and sewage issues at urban and rural scales, there exists due supervision on drinking and industrial consumption, but no proper undertaking yet to become operational on agriculture water utilization.

EXISTING MANAGERIAL STATUS OF IRRIGATION-DRAINAGE SYSTEMS:

Of total (3.2 m.ha) irrigated lands, only 53% (1.7 m.ha) enjoy <u>main canals</u> (to conduct reservoir water to downstream plots), of which, 700,000 ha. possess lateral channels. Moreover, certain systems do seriously suffer deficiencies of due tertiary or quaternary channels within the farms. On the other hand, initiatives as optimization of water consumption, rising irrigation efficiency, and maintenance of existing networks could, in no way, be effective enough mainly due to inappropriate formulation and implementation of viable programmes for sound utilization of allocated water to the end users.

Even, the subsidiary channels have faced to numerous constraints partly due to lack of sound management on their regulatory exploitation and maintenance having led to extensive seepage of the surrounding lands. This aside, common challenges faced by many plains and water-tables should also be accounted at national scale.

PRACTICAL SOLUTION FOR MANAGEMENT OF IRRIGATION-DRAINAGE SYSTEMS:

Upon experiences, public governance proved improper mechanism for utilization and maintenance of water establishments, hence, need to be replaced by another initiative to launch an efficient management on the systems. The best approach would focus on capable organizations to replace the government leadership and to ensure a productive management in exploitation and distribution of water and maintenance of the whole system.

Certain countries, which have the same governmental management on irrigation-drainage networks, have confronted with similar consequences, too. Moving towards participatory management patterns as experienced in Turkey, Kyrgyzstan, India, Sri-Lanka, Mexico and many other countries in Asia or Europe, confirm and recognize outstanding achievements in this regard.

Optimization of water consumption and rising irrigation efficiency can be simply materialized through transferring the responsibility of agricultural irrigation and drainage system to the real users and beneficiaries. Participatory management has proved to take positive steps in development of infra-structural affairs and production of agri-crops.

WELL-ESTABLISHED ORGANIZATIONS FOR EXPLOITATION AND MAINTENANCE:

Based on the 2nd, 3rd and 4th National Development Plans, water users have to organize themselves under legal bodies for due realizing the following liabilities:

- Possessing executive capacities;
- Interacting with public institutions;
- Undertaking commitments or acquiring responsibilities from their members and staffs;
- Empowering for legal reaction against offenders and free-riders; and
- Regulating legal inter-relations between the members and legislative bodies.

To this end, and among the available initiatives and approaches, certain models, for instance, rural cooperatives, production cooperatives, guild water users associations (GWUAs), agricultural corporations and private and public shareholding enterprises were identified followed by describing and evaluating their functional commitments through technical debates on SWOT aspects conducted by professionals in two consultative workshops. Meanwhile, "The Executive Committee for Optimization of Agricultural Water Consumption" entrusted the Dept. of Extension and Farming System[1] (in the Ministry of Jihad-e-Agriculture) for designing a viable pattern and modality to optimize water distribution and consumption as well as maintaining the related hydraulic structures in the irrigation networks. The affiliated Bureau took initiative in holding the 3rd workshop to raise the issue of the water users associations in

1- In fact, the Bureau for Development of Agricultural CBOs undertook the task under the DEFS jurisdiction.

consultation with participating professionals and stakeholders concerned. They represented the following executive bodies:

- Protection and Exploitation of Underground Water Resources- Ministry of Energy (MOE)
- Utilization System and Protection of Surface Water Resources- MOE
- Bureau for Development of Agricultural CBOs (MOJA)
- Bureau for Development of Agricultural Water Resources' Optimization and Consumption (MOJA)
- Secretariat of the Executive Committee on Codes for Optimization of Agricultural Water Consumption

The Workshop focused and deliberated on key issues as follows:

- Investigating the constraints geared to existing water users' associations including legal issues, participation of the users, public supports, management of associations, etc.;
- Examining the processes involved in establishment of associations for exploiting surface and sub-surface water resources;
- Exchanging views on adoption of various appropriate formats (association, cooperative, corporation, guild, etc.)

The Workshop was represented by different provincial managers of extension, soil and water, and water affairs, regional heads for water protection and utilization, directors of users' affairs and surface-water protection, members of provincial committees on codes for optimization of agricultural water consumption, and few other managing directors of irrigation-drainage systems' utilization.

Later, Analytical Hierarchy Process (AHP) was applied via expert choice software for analysis and identification of the most appropriate legal model for smoother interaction with public institutions. This technique is based upon peer comparisons and allows investigation of varying scenarios by managers. In the meantime, the multi-criteria group decision-making model was also employed by the AHP for simulation and adoption of the best water users' association. Results of the foregoing analysis indicate that Guild Water Users' Association (GWUAs) poses the best format for establishment, participation and accountability in water utilization field and maintenance of physical structures.

IRRIGATION – DRAINAGE SYSTEM OF GAZVIN PLAIN AND PERFORMANCE OF PUBLIC MANAGEMENT IN WATER UTILIZATION AND NETWORK MAINTENANCE

Development program in Gazvin Plain consists of integrated water and soil promotion projects which have been gradually shaped and evolved under the context of Gazvin Development Project (GDP). During 1974- 1991 and after approval and execution of "F" alternative for the system, main canal (94 kms) and lateral channels (1100 kms) were gradually constructed and became operational.

The system used to supply around 140 - 200 m.m^3/year (before operation of the Taleghan Dam) to irrigate net 60,000 ha. of lands classes I & II, covering 30,000 farmers under its irrigation service. The results of the public governance over the past decades (before shifting the irrigation service management to the local users) are briefed as follows:

1. Lack of a holistic plan for sound utilization and maintenance of the system and consequently early degradation of its segments;
2. Rapid demolition of almost all structures including checks & turn-out gates, C.H.O, farm inlets and other small and medium steel works in early years of running.;
3. Poor achievement of the initial objectives for gradual rising of efficiency, productivity, and hence, facing substantive drop in performance;
4. Unauthorized installation of inlets for non-standard irrigation of farm plots;
5. Improper water distribution and consequently misuse of the beneficiaries' water rights;
6. Inefficient artificial re-charging process through the modern Gazvin Network (only 15 m.m^3/ year) which highly lagged behind expected rate (61 m.m^3/ year);
7. Unprecedented increment of unauthorized wells and increase of water discharge from authorized ones;
8. Over-discharging of water-tables and severe drop in aquifer level through growing the wells and their up-taking powers;
9. Increase in number of risky settlements intensified by poor civil immunization attempts and rise in people or vehicles' casualties (almost 20 persons/ year).

The above-mentioned uncertainties have, no doubt, genesis in public management with poor quality and inefficient performance over the foregoing irrigation-drainage system in Gazvin Plain. This type of governance has utilized various establishments, workshops, warehouses, machinery, human resources and other assets which are now left as ruins after 30 years.

Over the exploitation years, some efforts were also made to attract farmers' participation into the network management which, however, failed to realize in action. Even, selection of local representatives for dispersed farming plans, local water distributors and encouraging peasants to organize themselves under legal associations at certain spots could never restore the situation or substitute the public management system.

NEW UTILIZATION DISCIPLINE BY WUAS (GAZVIN PILOT SITE);

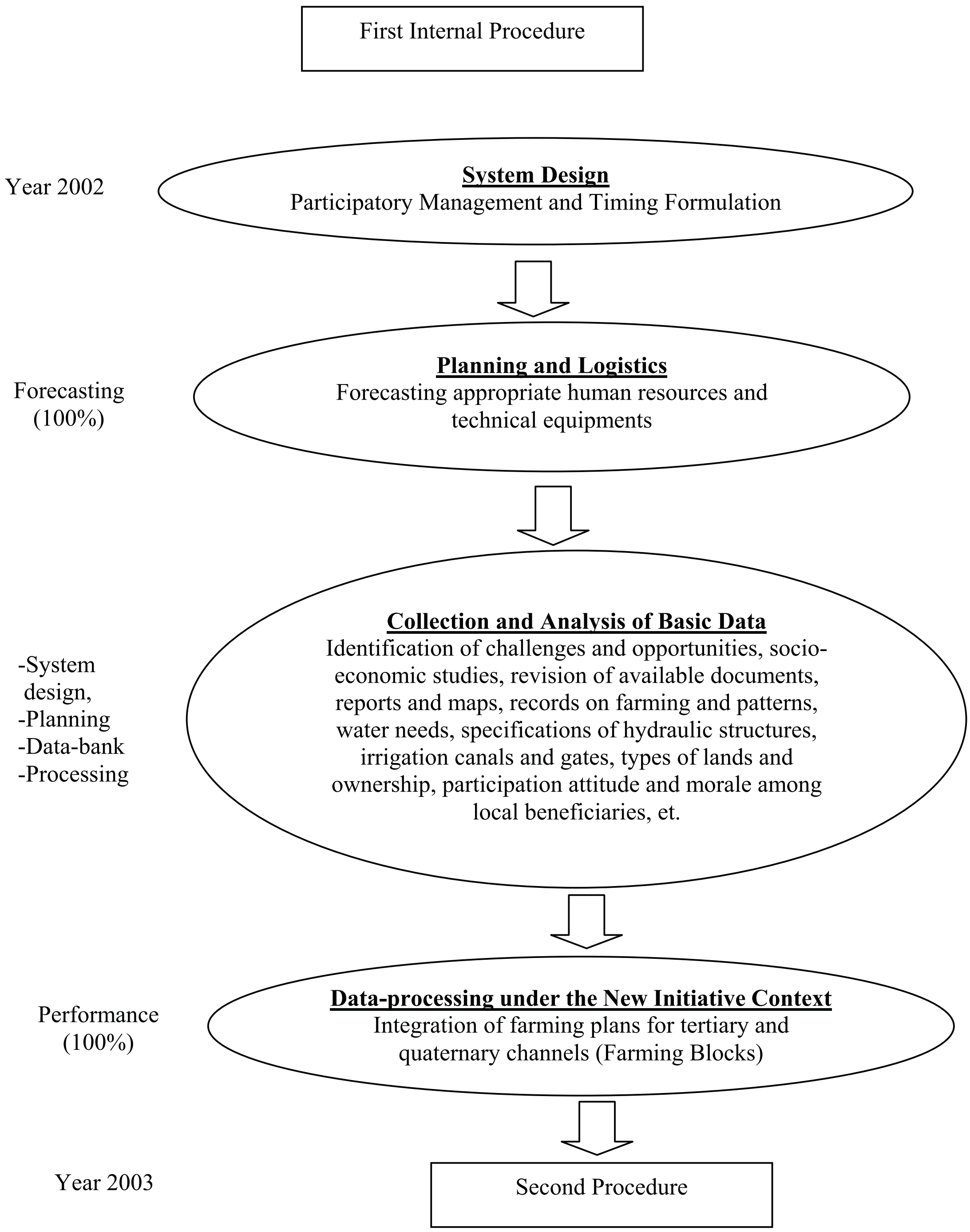
Following the global and national obligations which were incorporated into the national development plans, the foregoing pilot took initiative to launch a new participatory reform and management shared by local farmers in 2002. This scenario, however, encountered numerous challenges and resistances mainly posed by public officials to suspend or vandalize it, but the efforts finally led to creation of the water users associations covering 158 farming blocks with well-scheduled programmes and through following procedures in Gazvin Pilot Site:

Institutionalizing

For

Irrigation Management Transferring Initiative

New Utilization Discipline in Gazvin Irrigation-Drainage System



PROCEDURES UNDERGONE FOR INSTITUTIONALIZING THE NEW DISCIPLINE

1. Planning for logic participation of all real water users in network exploitation and rehabilitation processes with emphasis on community-based irrigation associations**:**

2. Ordering and prioritizing the operational and organizational procedures of the initiative:

   1.1.Farming plots for farms between 10- 20 ha.

   1.2.Faring groups for farms between 20- 100 ha.

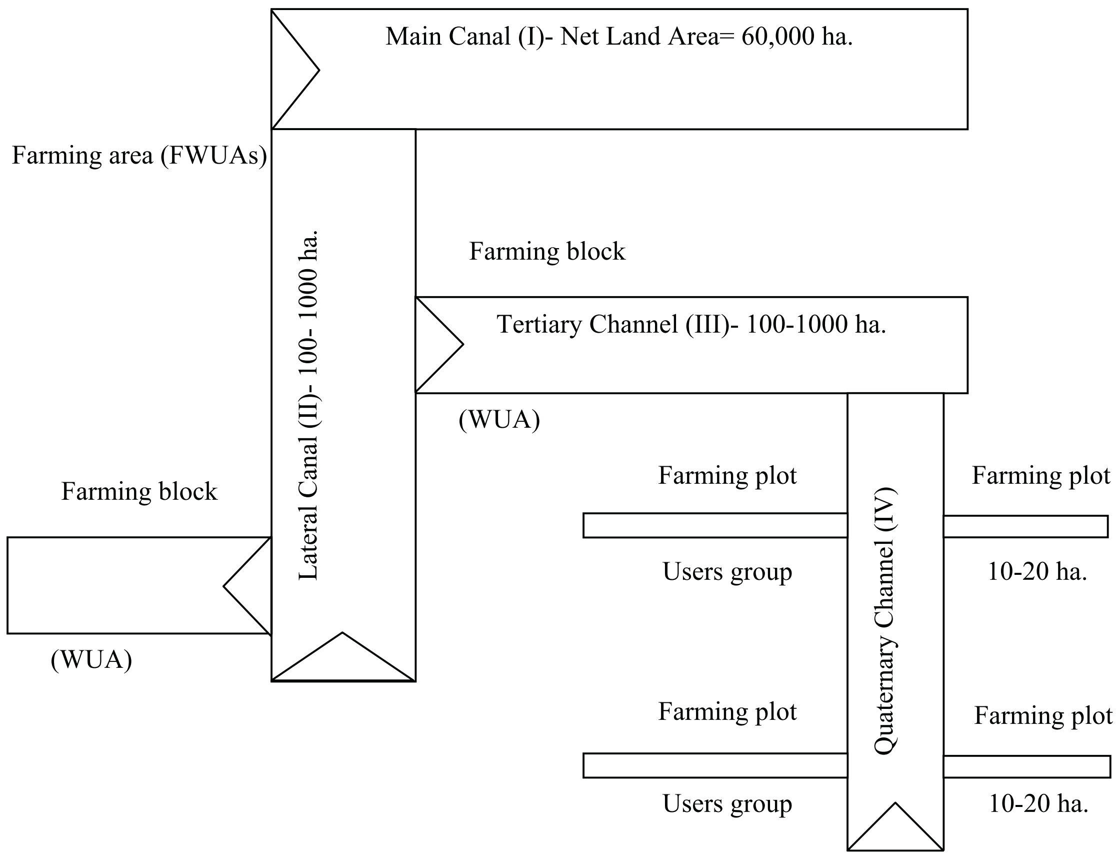
   1.3.Farming blocks for farms between 100- 1000ha.

   1.4.Farming areas for farms between 1000- 10.000ha.

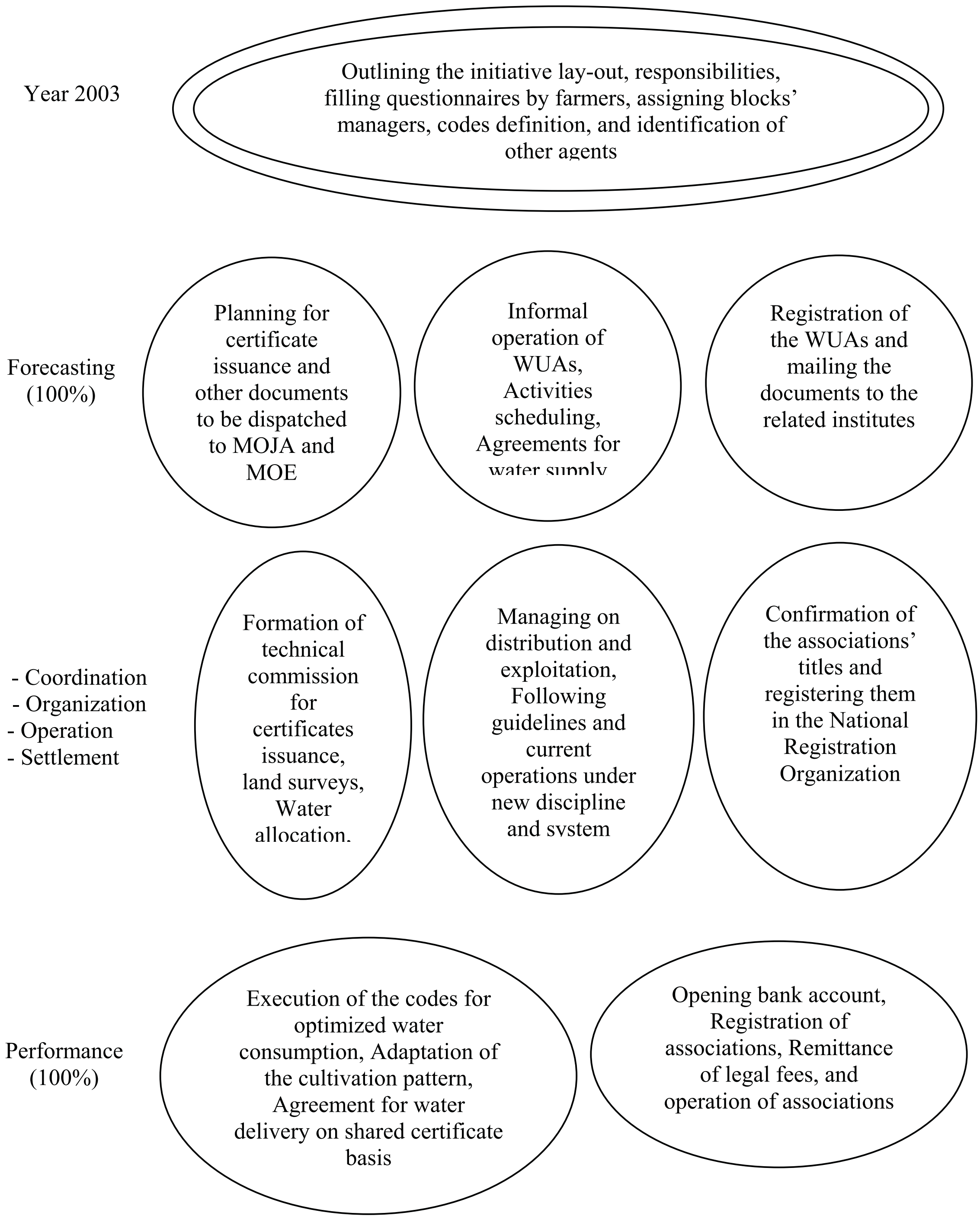
   1.5.Farming center for 80.000 ha. comprising 80.000 gross farmlands (net 60,000 ha.)

3. Volumetric delivery of water to farmers' representatives at inlet spots.

Gazvin Agriculture Center
Federation of Corporate Irrigation Associations

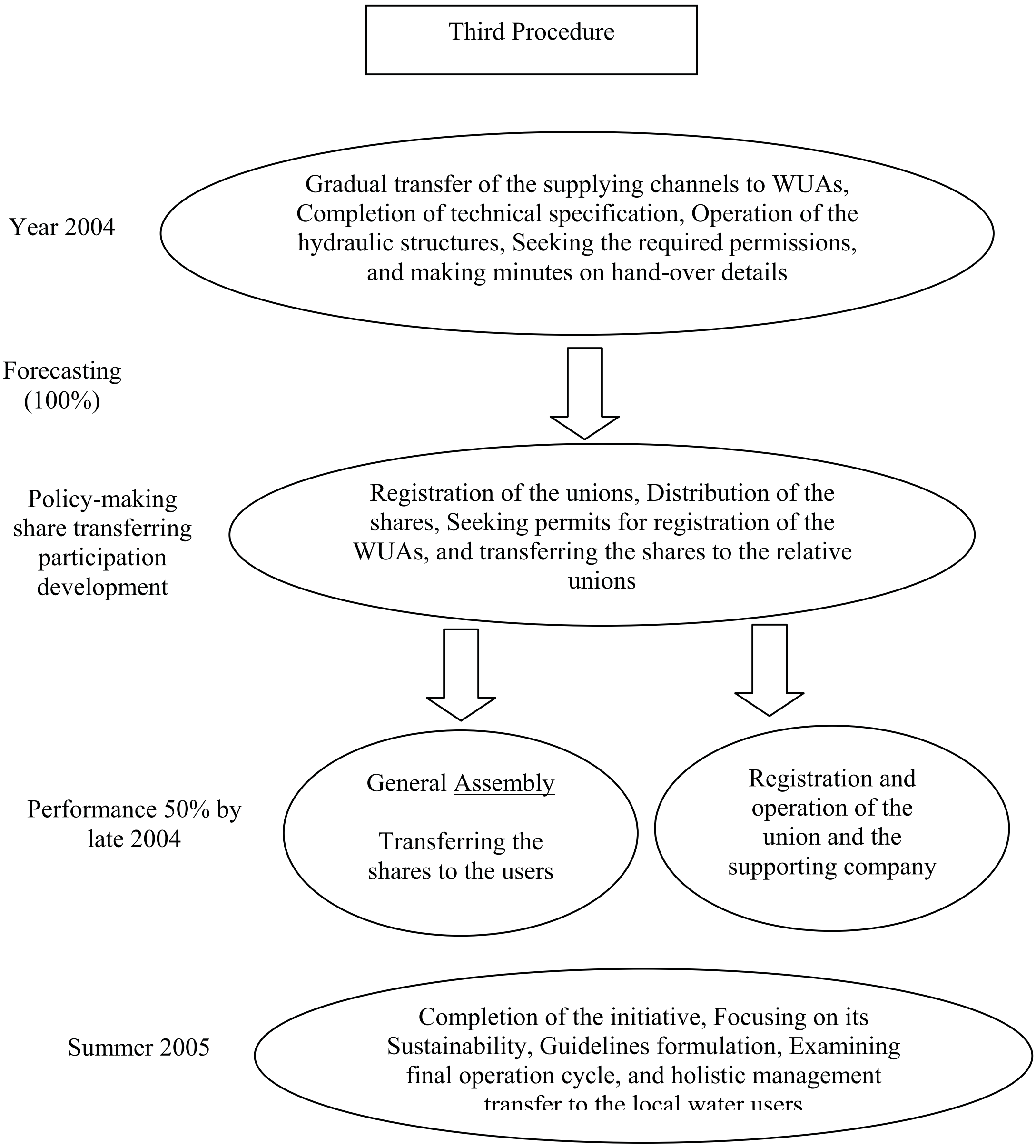


New Utilization Discipline in Gazvin Irrigation-Drainage System



New Utilization Discipline in Gazvin Irrigation-Drainage System

Head Office Affairs



WUAS' COMMITMENTS:

1. Acceptance and registration of demands for water purchasing from the network clients;
2. Examination of the demands with agreements' contexts on water supply, and making quota upon cultivation and irrigation patterns;
3. Planning and coordinating on selling, cashing and making turns for water delivery;
4. Exploitation and distribution of the network throughout 100 kms. of conveying canal and channels (II, III and IV);
5. Volumetric water delivery at farming blocks to the relevant WUAs;
6. Conducting executive affairs and supervising the WUAs operations at channels III and IV;
7. Regular patrolling the establishments followed by reporting the breaches and faulty measures, if any;
8. Accountability and entertainment of the users and removal of their bottlenecks at respective offices concerned.

MERITS OF THE INITIATIVE

Increase of	***Decrease of***
- People's supervision - Equitable water distribution - Wise maintenance of the system - Irrigation performance - Productivity	- Bureaucratic affairs - Public referrals - Government leadership - Production costs - Structural deterioration

INTEGRATED INITIATIVE FOR IRRIGATION MANAGEMENT TRANSFER TO WUAS IN GAZVIN PLAIN

Question	Will the initiative be successful at the end?
Plan	Just an opportunity!
Perspective	Other Govt. Institutions National Water Authority Local Farmers Union of WUAs Canal and transfer of shares Provincial Office of Jihad-e-Agriculture Water users' trustees
Answer	i) Existing status → Resources' waste → Crisis ii) Transfer 100% → Participation → Sustainable Development

EXISTING CHALLENGES FACED BY WUAS:

1. Poor transparency of their positions, authorities, commitments, and relation with the existing Network Utilization Company;
2. Lack of a decisive will in public institutions to support and cooperate with WUAs;
3. Inadequate financial mechanism to back up the newly established WUAs, nor partial allocation of water charge yet realized to support them;
4. New circulations made by the MOE to mobilize emerging contractors who will act as strong competitors parallel to WUAs and eventually retain government management on the system.

RECOMMENDATIONS:

1. Legal formulation and definition of management pyramid on irrigation-drainage systems;
2. Identification of pertinent governmental and non-governmental institutions as well as their inter-relationships for increased transparency and decreased personal interference of middle managers;
3. Consideration of adequate fund for rehabilitation of degraded parts imposed during the public management times;
4. Empowering the newly created WUAs through concession of water charge delivered to them;
5. Conducting certain pathological studies on WUAs and regular surveillance on achievements and obstacles by national development plans;
6. Implication of the outputs in other potential areas.

REFERENCES:

1. *1st Consultative Workshop on executive Strategies for Water Users' Association* (surface and sub-surface water resources), held by the Bureau for Development of CBOs in Agriculture Sector, late 2004.
2. *2nd Consultative Workshop on executive strategies for Eater Users' Association* (surface and sub-surface water resources), held by the Bureau for Development of CBOs in Agriculture Sector, early 2005.
3. *3rd Consultative Workshop on executive strategies for Eater Users' Association* (surface and sub-surface water resources), held by the Bureau for Development of CBOs in Agriculture Sector, mid 2005.
4. Dr. Abdollahi M., *"Farming Systems in Agriculture*", an adaptive study, Ministry of Jihad-e-Agriculture, Dept. of Extension and Farming System.
5. Dr. Raanaie H., *"Examining the Structural Patterns of NGOs in Agriculture Sector",* Ministry of Jihad-e-Agriculture, early 2003.
6. *"Planning Tips for Rural Centers",* publication of the Rural Research Center, 1992.
7. *"Regulations and Guidelines for Cooperatives",* 1st vol., publication of the Ministry of Cooperation, 1997.
8. *2nd National Development Plan of Iran*, MPD, Socio-Economic Documents Center.
9. *3rd National Development Plan of Iran*, MPO, Socio-Economic Documents Center.
10. *"Law of National Corporate System"*, Islamic Consultative Parliament, Sadra publication, 2004.
11. *Documentation of the new management system in irrigation-drainage network of Gazvin Plain- Initiative for Irrigation Management Transfer*, of Utilization Company of Irrigation-Drainage System in Gazvin Plain, 2004.
12. *The Dublin Statement on Water and Sustainable Development Dublin*, Ireland, January 31, 1992.
13. *United Nations Conference on Environment and Development (UNCED)* in Rio de Janeiro in June 1992, Agenda 21.
14. *World Bank Guidebook on Participatory Irrigation Management*, 1998, http:/www.worldbank.org
15. FAO, 1999*, Irrigation in Asia in Figures*, FAO Water Report no. 18, FAO, Rome.
16. Vermillion < D…, 1997, *Management Devolution and the Sustainability of Irrigation:* Result of comprehensive versus partial strategies presented at the FAO/World Bank consultation on Decentralization and Rural Development, 16-18, December 1997, Rome.

PARTICIPATORY IRRIGATION MANAGEMENT IN KELARA KARALLOE IRRIGATION PROJECT, SOUTH SULAWESI, INDONESIA

Mohamad Hasan[1], and Syamsudin Mansoer[2]

ABSTRACT

Despite the rapid industrialization in Indonesia over the last few decades, irrigation development for paddy remains a strategic endeavor for enhancing the nation's food security program, in particular, and stability of agricultural productivities in general. This is particularly the case during the effort of the government to recover the multi-dimensional economic crises since 1997.

In an attempt to support sustaining irrigation development and management, for acceleration and stabilization of food security while maintaining appropriate level of agricultural production, the government has given special scrutiny on management of the existing irrigation scheme while pursue some selected development for new schemes. These include the construction of new irrigation schemes on the "Outer Islands", rehabilitation, and reconstruction as well as upgrading of the existing schemes on the Inner Islands (Java).

In line with the development efforts, it turned up that the massive development and rehabilitation implementation have been significantly constrained by variety of predicaments for pursuing effective operation and maintenance (O&M) under the limited capacity of the farmers to participate supporting the farm level irrigation management. Therefore, the government policy has been adjusted from initially centrally managed toward decentralized O&M approach, giving opportunity for the farming communities (through their water users' association – WUA) to participate in all aspects of irrigation development and management.

This paper presents a series of experiences on participatory irrigation management efforts in Kelara Karalloe (KK) irrigation projects, as the pilot model, in South Sulawesi Province – Indonesia, giving some elaborations on participatory process of

1-Ir. Moh. Hasan, Dipl. H.E., Senior Irrigation Specialist, Directorate General of Water Resources, Ministry of Public Works, Jalan Pattimura No. 20, Kebayoran Baru, Jakarta. Indonesia.
mohasan@centrin.net.id
2- Drs. Syamsuddin Mansoer, Senior Irrigation Operation and Management specialist, Directorate of Irrigation, Directorate General of Water Resources, Ministry of Public Works, Indonesia

rehabilitation, upgrading, and repair of the irrigation schemes, as well as post rehabilitation operation and maintenance phases.

Key words: Participatory Irrigation Management, Kelara Karalloe Schemes, South Sulawesi – Indonesia.

I. GENERAL BACKGROUND

In spite of the rapid industrialization of Indonesia over the past 25 years, and the rise in importance of the oil and gas industries, agriculture continues to play a central role in the economy, generating rural employment, earning foreign exchange, and safeguarding basic food security against over dependence on foreign imports. The strategic role played by rural areas in the national economy is evidenced by the fact that about 46% of the total working population (in 2003) has employed by the agriculture, forestry and fisheries sector.

Irrigation, and in particular rice paddy irrigation, plays a strategic role in the ongoing stability and productivity of the agricultural sector. This has been prioritized by the government to be the significant investment on irrigation infrastructure over the last few decades, both in building new schemes and in repairing/upgrading existing schemes. About 61% of the rice grown in the country is irrigated (6.7 million ha), of which over 80% comprises state-run irrigation systems.

However, the quality of maintenance and upkeep of the dams, weirs, canals, and structures has been a cause of concern for decades and continues to be unsatisfactory, characterized by shortages of funds and skilled manpower.

While irrigation technologies are relatively simple, their operation is not, involving hundreds of control structures with gates, thousands of hectares of paddy fields and thousands of farmers who have varying need for water to irrigate varying crops at different stages of growth. This, together with the need to conserve and optimize the use of the available land and water resources, is a continuing challenge for the government and for system operators.

Sizeable increases in crop production are thought to be possible from existing irrigation areas if improved operation and maintenance (O&M) strategies can be devised and implemented in a sustainable manner. Over the last few decades, government priorities have changed from centrally managed and funded O&M organizations to more decentralized systems, with maximum participation by all levels of society. Particular emphasis is directed to farmer beneficiaries who have the most to lose from deteriorating infrastructure and from irrigation system water shortages.

The initial experience prior to rehabilitation of the sizeable Kelara Karalloe (KK) weir irrigation scheme in South Sulawesi may be typical of many of such examples throughout the country, involving steady deterioration during the 1990s, problems resulting from the 1998 crisis and subsequent confusion/opportunities linked to decentralization. A review of the lessons learned during the effort to repair/upgrade the KK irrigation system between 1999 and 2003, and the subsequent success of the level of farmer participation during post-rehabilitation operations, may help in planning and implementing similar rehabilitation exercises elsewhere.

II. THE STUDY AREA (KELARA KARALLOE SCHEME)

2.1. PROJECT LOCATION AND CLIMATIC CHARACTERISTIC

The Kelara Karalloe irrigation scheme is located near the town of Jeneponto on the tip of the south coast of South Sulawesi, some 105 km to the south of the provincial capital, Makassar, in Jeneponto District (*Kabupaten*).

Jeneponto is one of the poorest and driest Districts in South Sulawesi and the name itself means "water bracelet" in the Makassarese language, suggesting "water is valued like gold". This area experiences low rainfall (only 1,000 mm to 1,500 mm per year), significantly less than the adjacent Kabupatens of Bantaeng and Takalar, because it lies in a unique rain shortage zone between the southeast and southwest monsoon areas of the two sides of the South Sulawesi peninsular. No doubt due to these tough conditions, the Jeneponto people have developed special cultural characteristics and are recognized as though, independent-minded individuals.

Since agriculture dominates the Jeneponto economy, local prosperity depends very much on the vagaries of the wet and dry season rainfall patterns. Thus, the irrigation scheme built on the Kelara River in the early 1970s (the Karalloe weir was added in 1983) is very pivotal to the local economy.

2.2. IRRIGATION INFRASTRUCTURES

Parts of the KK irrigation area were irrigated by water from an old irrigation scheme constructed before Indonesian Independence. However, the big improvement came with the construction of a weir and intake on the sizeable Kelara River in 1974, together with the long and difficult main link canal (11.4 km including three tunnels) and canals. Water from the nearby Karalloe River was added in 1983. Other additions have been made over the years and the whole scheme now covers 7,004 ha of bounded paddy land, with 13 secondary canals totaling more than 70 km. in length.

Because of the inconsistent rain in the wet season, irrigation is important during both the dry and the wet seasons. However by 1998, due to a variety of reasons, chief of which was deteriorated irrigation infrastructure, the KK irrigated area had declined to less than 1,000 ha (16% of its designed capacity) over the years. There were continuous complaints from farmers, and demands for improvement. The shortage of water led to permanent social discord and the farmers themselves destroyed and damaged the irrigation works in attempts to divert water away from their neighbors' lands, and into their own fields. There were no water sharing plans or staggered plantings, and coordination of irrigation and water management (by government officials) was poor.

A storage dam was proposed as a solution to the water shortages. There is ample water in the two rivers in the wet season, and there are good locations for a storage dam, but construction would be expensive and take some time. It was recognized that the existing irrigation and agricultural land resources were vastly underutilized due mainly to poor water management. Good irrigation and water management was not possible without full commitment, cooperation and participation of the KK farmers and the local community.

Hence a study was undertaken between 1998 and 2000, with the aim to clarify the real causes of the water shortages by collecting and analyzing data and information on the project from both government officials and local farmers, and by making recommendations for improvements. Measures aimed to improve irrigation and water management were implemented between 1999 and 2002 using participatory methodologies promoting farmer participation.

III. THE WATER MANAGEMENT IMPROVEMENTS PROJECT

3.1. THE WATER MANAGEMENT IMPROVEMENT STUDY

The complete water management improvement study (WMI study) originally was designed to be completed in three stages: namely study, implementation of rehab/upgrade works, and implementation of new water resources development. The WMI study was started in July 1998, and completed in three phases by late 1999.

The findings of the WMI Study were:

- The main canal carrying capacity was too small, reduced to 25% of total requirement by defects in the canal, and limited to 50% by the carrying capacity of the tunnels.
- The secondary system was in a poor condition, with heavy sedimentation and siltation, and many broken and leaking canals (some due to "artificial damage").
- The tertiary system was either non-existent or in a poor state of repair.
- Water management was very problematic due to a lack of farmer commitment and involvement, possibly arising from the continuous shortages of water and the special character of the local people.
- Agricultural practices were poor, cropping patterns emphasized limited planting of paddy in the dry season rather than extensive areas of palawija,
- Farmers were not involved in the O&M at all and were belligerent spectators. Water Users Associations (WUAs) existed but were not respected and did not really function.

The average actual cropping intensity for the two years prior to the WMI study (1996 and 1997) was found to be only 126% (Paddy-Paddy and Paddy-Palawija) including a lot of rain fed paddy in the wet season. Yields were around 2.5 t/ha (paddy), 1.0 t/ha (maize) and 0.5 t/ha (green gram). If standard water requirement calculations were used, with main canal capacity only 3 m^3/s, it was found that only 923/805 ha (wet/dry seasons) of Paddy-Paddy, or 923/2,044 ha of Paddy-Palawija could be reliably irrigated.

Through an action plan, various options for improving the water availability in the system, including three main alternatives, were considered, namely:

Option 1: Rapid rehabilitation (urgent minimal rehabilitation), to return the system to good condition including reclaiming the main canal capacity to 6 m^3/s. Construction works would take 1 to 2 years but the system would be operated throughout, and benefits would be generated gradually, as work progressed. Cropping intensity could be increased to 7,004/2,215 ha (Paddy-Paddy) or 7,004/5,944 ha (Paddy-Palawija).

Option 2: The rapid rehabilitation mentioned above with the addition of main canal reconstruction to increase the capacity to12 m^3/s.

Option 3: The two options mentioned above, plus development of a dam/ reservoir to supply irrigation water for 7,004 ha.

The advantages of the first option that was selected were very clear:

- Almost the whole service area could be planted with palawija in the dry season;
- The cost was relatively low and benefits were substantial and could be realized very quickly; and
- Disruption to water supplies was minimal.

3.2. IMPLEMENTATION OF RAPID REHABILITATION

Work was carried out in eight separate contracts between 1999 and 2003 for:

- Formation and strengthening of farmer groups (by NGO);
- Training of operators and farmers in good O&M practices;
- Provision of O&M equipment;
- Design of rehabilitation of secondary and tertiary system;
- Construction of a water management training center;
- Rehabilitation of the main canal;
- Rehabilitation of the secondary system; and
- Repair and reconstruction of the tertiary system.

In addition, the consultant team undertook water management improvement measures along with improved agricultural techniques through demonstration farms in the KK command area.

3.3. IMPROVEMENTS IN PRODUCTION

The improvements since 1998 have been dramatic with major increases in agricultural production both from (a) increased irrigated areas under cultivation during the wet and the dry seasons and also from (b) increases in yields/ha. The KK scheme area has increased to 7,199 ha.

Furthermore, the enthusiasm of the farmers has improved dramatically, involving full participation in operating the system and contributions to running costs. The farmers in the KK area have become more satisfied with their lot, forward looking and optimistic. Rather than regularly clashing over water, they now cooperate for mutual benefits in the operation and maintenance of the KK irrigation scheme.

The farmers' agricultural skills have improved dramatically. They have been willing to try new agricultural methods and techniques. The SRI (*System of Rice Intensification*) cultivation method has been widely adopted and has moved well past the experimental stage, with the farmers themselves spreading information among themselves. Crop diversification has also been successful. There is an increasing trend towards dry season cultivation of high yield varieties of maize.

IV. CHRONOLOGY OF OPERATION AND MAINTENANCE OF THE KELARA KARALLOE SCHEME

4.1. THE PERIOD BEFORE 1998

The Kelara Karalloe irrigation scheme was managed by Public Work Services through the Provincial O&M office in Makassar through a standard Irrigation Management Units (*Ranting*)/Sub-unit (*sub-Ranting*) system. There were two Rantings: one for the weir and main canal; and one for the irrigation system below the main off takes.

In spite of relatively generous O&M funding, and a stable O&M staffing structure with several long-serving mangers and operators, during this period (up to 1998), the KK scheme steadily deteriorated due mainly to poor management. The Main canal had several leaks and blockages so that its capacity was severely limited even when there was sufficient water in the river. The weir intake gates leaked and malfunctioned, and access to the stretches of the main canal between the tunnels was difficult. The access road had been planted in crops by land hungry farmers. The secondary canals were broken in many places. Gates were broken and malfunctioning. Water was wasted in the upper reaches and never reached the lower/middle reaches. Farmers were perpetually in conflict over water and staff of District offices had endless complaints about the scheme

Even with severe water shortages, there was no attempt to conserve and optimize the water availability through water sharing or rotations. Upstream farmers planted dry season paddy and took whatever water they wanted. There was a traditional annual meeting to decide on KK planting dates and cropping patterns.

Farmers were organized into nominal WUAs, but these were ineffective. Leaders and officials were chosen by local politicians, and by 1998 the WUAs had basically ceased functioning. Under the old regulations, water user fees were to be collected by the WUAs to be used as the government decided, with little connection between payment and level of service. Clearly, with the KK scheme in such a poor state of repair, the local farmers were reluctant to pay irrigation fees, and collection levels were low. Most farmers didn't pay.

4.2. THE PERIOD DURING ECONOMIC CRISIS (1998 TO 2002)

The *Ranting* management system continued after the sudden crisis starting in 1998 that resulted in a severe reduction in funding for O&M and skyrocketing increases in costs of basic foods and essentials. Ironically, management of the KK irrigation scheme during this period saw steady improvements in crop production, with increased dry and wet season plantings and increases in crop yields. This was made possible by the start of the SSIMP3 rehabilitation project, which brought extra funding and expert advisors not available before.

The improvements were also due to the determination of the farmers to grasp the opportunity to improve their own lives. The KK scheme farmers stepped forward to participate in all aspects of O&M to improve and safeguard their own livelihoods. They enthusiastically joined and participated in WUAs and provided labor for small maintenance works and for control of gates.

4.3. DECENTRALIZATION PERIOD 2002 TO 2005

The Presidential Decree 1999 (Irrigation management policy reform) proposed decentralization of O&M of irrigation systems of all sizes to Districts with a longer term aim to hand over the responsibility for O&M to organized farmer groups and Federations. At the local level, this resulted in a reversion to the former Ranting/Sub-ranting system, but in this case organized and managed by *Bupati* and his staff. As elsewhere in Indonesia, budgets were reduced and many Districts had trouble coping with the new responsibilities, O&M staffs were reduced, and irrigation schemes went into a spiral of decline in performance and productivity.

One disappointing aspect during this period concerned the collection and use of irrigation fees. A local government by law instructed WUAs to collect water user fees and deliver the cash to District government accounts. The District government would then decide (with consultation) when and where it should be spent. Again, farmers did not have confidence that the irrigation fee collections would be used wisely and collection levels were very low. However, with reference to irrigation O&M internal activities within the WUAs themselves and the WUAF, the farmers contributed willingly. There was several maintenance activities carried out by farmers themselves, or through working together local authorities' local government financed work.

4.4. O&M UNDER THE NEW LAW NO.7/2004

The New Water Resources Law enacted in 2004 rationalizes O&M responsibility which is assigned to three administrative levels (Central / Province/District) with the designation of responsibility depending on scheme size (>3,000 ha / 3,000-1,000 ha / <1,000 ha). In addition, WUAs are delegated the responsibility for the construction and O&M of tertiary systems. Under the revised arrangements, the central government will take responsibility for the KK scheme, given its size. The mechanisms and organizations are still evolving, but will certainly involve partnerships, mutually agreed between the different administrative levels for implementation of O&M, depending on the abilities and willingness to participate of each level.

Given the positive experience and clear benefits of good water management practices seen over the past eight years, the provincial and district governments, the WUA Federations, the WUAs and the farmer beneficiaries are all well prepared and ready for whatever the new arrangements will bring, and hopefully the outcome will lead to a further increase in productivity of the KK system.

V. PARTICIPATORY IRRIGATION MANAGEMENT AT THE KELARA KARALLOE

The KK scheme lies wholly within the Jeneponto District (Kabupaten), within 5 Sub-district and 24 Villages. The scheme area covers 7,199 ha, divided into 2,157 tertiary blocks, with 51 WUAs and 11,264 farmers.

5.1. PUBLIC WORKS ORGANIZATION FOR O&M

Under the new regulations, the primary financial responsibility for irrigation O&M of the primary and secondary canals and structures for the KK scheme (>3,000 ha) rests with the central government. The regulations and the organization to accomplish this are still being finalized, but the arrangements in 2006 are:

Funds for O&M are contained in the national funds (APBN) administered by the Project Manager in Makassar. However the system is in transition and some costs are still being covered by Kabupaten funds (APBD). In organizational O&M terms, distinctions are drawn between procedures used for operation, or "O", and maintenance, or "M".

The current organization for operating the KK scheme is still the old organizational framework derived from the decentralization era, involving 34 staff, all of whom employees of Kabupaten Jeneponto, covering two Irrigation Management Units (*Ranting*) and seven Sub *Ranting*. There is 34 staff at the scheme, comprising four civil servants (Ranting heads and staff) and 30 gate operators. The salaries of the civil servants are still paid from APBD, but those of the gatekeepers are paid from APBN mentioned above. However management and control of operation of the KK scheme is completely handled by the Kabupaten management team. All other operating costs (office, transport, communication) are still borne by the Kabupaten through APBD.

5.2. THE USE OF INTERMEDIARIES AS FACILITATORS

A very critical component of the program to promote active involvement by local farmers and leaders in the development of the WUAs and WUAFs, and in improvements in irrigation management and agricultural skills, was the sustained use of intermediaries as facilitators of capacity building elements. These intermediaries comprised locally-based NGOs with previous experience in participatory irrigation management in other SSIMP schemes during earlier phases, who were supervised by selected Consultant staff.

The NGO intermediaries (or facilitators) worked closely with local government agency personnel and remained involved with activities in the KK scheme on a sustained basis, rather than short-term inputs. They thereby developed local expertise and effective relationships with local farmers and WUA/WUAF leaders. The local entities had confidence in the intentions and skills of the intermediaries and in their acquired practical local knowledge.

5.3. FARMERS' ORGANIZATION

The basis of participation by the farmers in the KK scheme is through their WUAs and WUAFs. The KK scheme area (7,004 ha) is divided into 3 WUAFs with 51 WUAs and a total of 11,264 farmers as follows:

WUAF Abadi: This federation covers the eastern part of the scheme area, comprising 3,241 ha in 46 tertiary blocks, with 25 WUAs and 5,072 farmers

WUAF Abulosibatang: This federation covers the central part of the area, comprising 446 ha in 24 tertiary units, with 10 WUAs and 2,710 farmers.

WUAF Turbin: This federation covers the western part of the scheme area, comprising 2,157 ha in 40 tertiary blocks, with 14 WUAs and 3,081 farmers.

The remaining area (355 ha) lies in small parcels along the Kelara Main Canal, each served by separate off-takes and with 2 WUAs, 15 tertiary blocks and 401 farmers. The Supreme or apex (induk) WUAF is still in embryo form and has not yet been finalized. In the interim, the PU managers continue to coordinate with each Federation leader on O&M matters.

5.4. PARTICIPATION BY FARMERS IN O&M OF THE KK SCHEME

The most significant part the WUAFs play in O&M at the KK scheme is in water scheduling and distribution.

- When irrigation water availability is adequate, or between 4 and 6 m^3/s, the three WUAFs divide irrigation supplies at the major diversion structure in proportion to their areas and then guard those settings.
- When the available water falls below 4 m^3/s, the WUAFs switch to irrigation rotational procedures, involving a 2.5 - 2 - 2.5 days allocation for each of the three WUAFs. Within each WUAF sub-command, schedules have been developed for sharing water between day blocks and night blocks. Each block is split again into roughly 1/3rd of their areas, with each sub-area getting an allocation for the 1st, 2nd or the 3rd day.

The WUA Federation leaders propose the schedules and the gate operators carry out their instructions for the setting of the gates.

This kind of water scheduling needs a high degree of cooperation among water users. It is unlikely that government operators could achieve satisfactory performance levels at the KK scheme without the involvement of the WUAs/WUAFs. The federation leaders ensure that their members obey the scheduling rules and have developed sanctions for persistent offenders.

As can be seen from the description of the organization for O&M described above, it is still in process of adapting to the new national policies. Farmers continue to participate in irrigation O&M activities in several ways:

- Farmers are mobilized on a voluntary group basis under traditional practices (*Gotong Royong*) two times every year just before the start of the planting to undertake light maintenance work in the secondary canals, such as clearing sediment, grass cutting, small lining repairs.
- The farmers themselves decide on cropping patterns and water distribution schedules, and the Bupati issues appropriate instructions based on these group decisions. The WUAs and WUAFs have agreed on sanctions to be imposed on farmers who do not follow the agreed crop and water schedules and then waste valuable water.
- In previous years farmers collected funds informally for use in O&M where they saw a need. In 2005 they lobbied successfully to change the by-law about water user fees going to Kabupaten accounts. Under revised procedures, the WUAFs

can now keep the funds for their own internal WUAF use. Starting in 2006, they will strictly enforce payment by members at a level of Rp.25,000/season/ha, and 20% of members have so far paid these amounts.

- The farmers themselves have greatly expanded the area cultivated in *palawija* crops during the dry season so that more area can be planted. In 2005 this *palawija* area had increased to 2,500 ha, with only 1,500 ha of paddy.
- In 2003 the Karalloe weir sluice gate stem seized up and could not be closed. The government at that time had no funds for repair so the farmers paid for the repair themselves.
- At the end of 2005 there was a serious landslide into the main canal, completely cutting off irrigation flows at a critical time before wet season plantings. The irrigation maintenance funds through APBN had been allocated elsewhere and there was no money available for this work. At the initiative of the WUAF leaders, repair work was initiated by requesting Kabupaten assistance with heavy equipment, and the WUAs themselves arranged to provide the necessary labor to clear the blockage.

V. LESSONS LEARNED AT KELARA KARALLOE

(1) Rehabilitation of an operating irrigation project needs full participation by the beneficiaries and a multi-disciplinary approach involving farmer group strengthening, improved agricultural practices, training in O&M and repairs to the infrastructure. Placing too much emphasis on construction works at the expense of these preceding activities can lead to disappointing results.

(2) The whole-hearted support of local government is an essential prerequisite for successful participation. In Jeneponto District, the Bupati gave his full attention and support to the improvement measures proposed for the KK scheme.

(3) The appropriate emphasis for improvement works should be on improved water management and increased crop production. An overall water management study, carried out before improvement works start, is highly useful and effective in producing a successful strategy. Full consultation is needed with all stakeholders focused on finding the real problems and proposing real solutions.

(4) The promise of funds for rehabilitation can be a great incentive for farmers to change negative perceptions and to increase participation in necessary irrigation O&M activities.

(5) Participation must be meaningful and involve empowerment of farmers. Previous attempts to use WUAs as government tax collectors failed because the benefits of participation were one sided.

(6) Participation can be improved by the sustained use of neutral groups as who can be trusted by farmers (consultants or NGOs) as intermediaries and facilitators, as was done in the case of the KK scheme improvements.

(7) The participation model must be suitable for local conditions, not a standard and uniform system imposed from above. For example, in the KK scheme, the sizes of the

WUAF areas are not equal, the main canal was left out of the water scheduling, and efforts were made to ensure that the traditional local leaders were involved from an early stage, thereby co-opting potential opposition.

(8) Designing WUAF sub-commands of unequal sizes areas is not necessarily a problem. It is much more important that the Federations are granted total control of the water in their areas

(9) A step-by-step approach to initiating irrigation physical, organizational and management improvements is recommended. At the KK scheme, the rehabilitation was carried out in several separate stages, with the early stages generating significant benefits for all, which in turn led to a greater willingness to participate and cooperate in future activities and stages.

(10) Continued support and training after physical works are completed generate positive additional impacts on active participatory water management and outcomes.

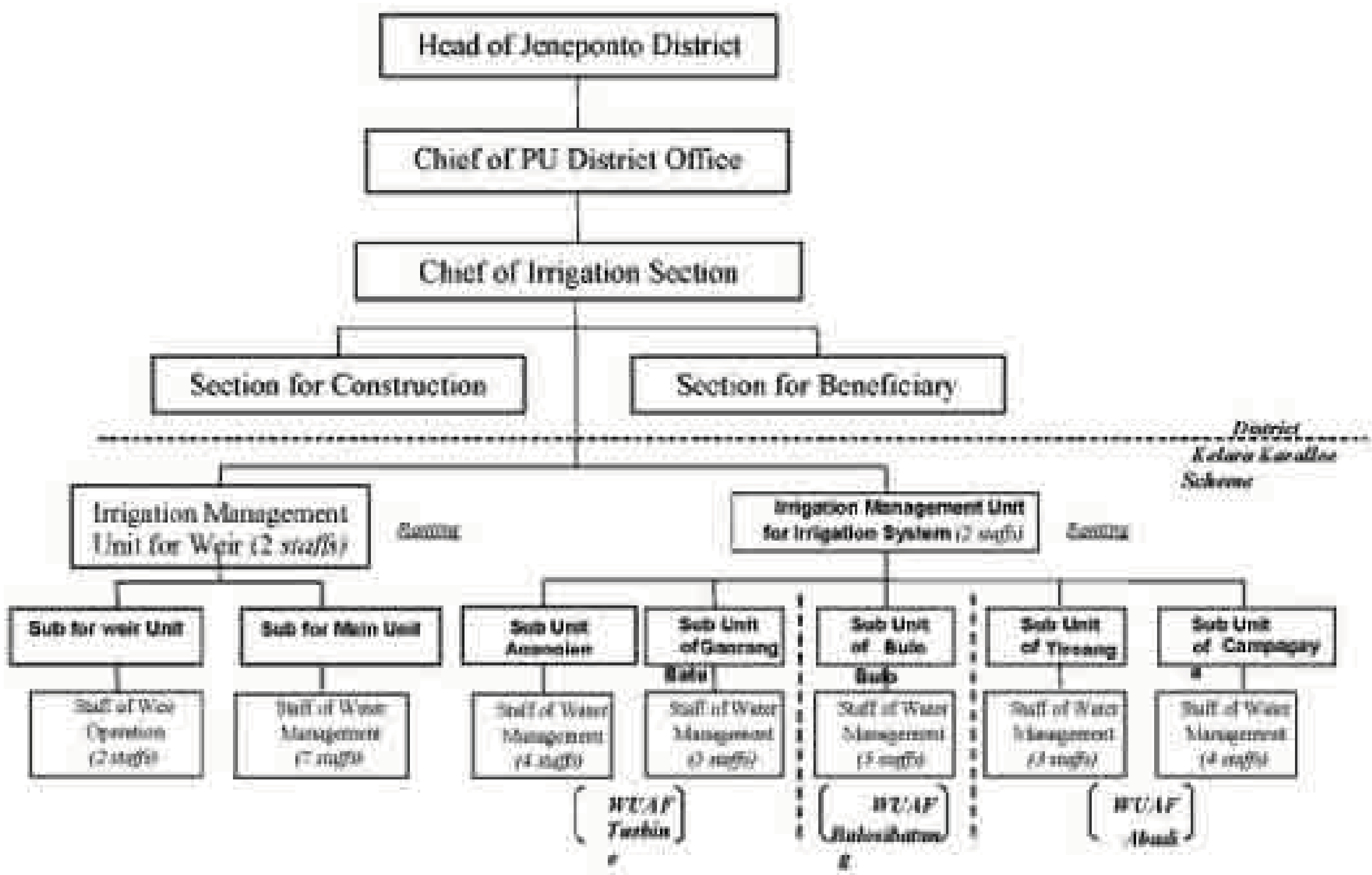
(11) Study tours conducted outside of the geographical scheme area, including alternative cultural settings, proved to be highly effective in demonstrating modern O&M practices. At Kelara Karalloe, the farmers were taken to East Java irrigation schemes where the WUAF leaders had a high level of positive involvement in O&M matters.

REFERENCES

1. Government of Indonesia, 2004, Republic of Indonesia's Law No.7 Year 2004 on Water Resources, Directorate of Water Resources and Irrigation, Ministry of National Development/National Planning Agency, The Law, 55, The Explanation, 55, Indonesia.
2. Government of Indonesia, 2006, Government Regulation No. 20/2006 on Irrigation, Directorate General of Water Resources, Ministry of Public Works, 62, Indonesia.


General Plan of

Figure O&M Organization for Kelara Karalloe Weir Irrigation Scheme in Jeneponto District



PRIVATE SECTOR PARTICIPATION IN SHAHID YAGHOBI MINOR IRRIGATION NETWORK

Hadi Tashakori Beheshti[1]

1- PREFACE AND OBJECTIVES:

Shahid yaghobi dam's irrigation network went under operation in the year 2000.

In development and promotion of modern irrigation methods, specially pressurized networks, to obtain defined efficiencies in the main irrigation network, design stage studies of 3rd and 4th grade network, started. emphasizing the importance of the design stage of 3rd and 4th grade irrigation networks, conforming to the demands of farmers, required public participation in the process of studies.

During the studies, the consultant insisted on accomplishment of public participation studies which have a controlling role in studies of minor irrigation networks, and consequently the contract of public participation was concluded.

The study area is located in central region of Khorasan province and South-east of Torbat-e-heidarieh town, where Shahid Yaghobi irrigation network is located. The area have arid and cold climate, with respectively cold winters accompanied by rain, and hot-dry summers. Mean annual rainfall of the area is about 240 mm, which mostly occur in winters.

The major surface water resources of the region are Kal-e-salar river, which is regulated by Shahid Yaghobi dam and supplied to farmers through main irrigation network canals. Ground water resources, as 13 wells supply 560 lit/sec of water.

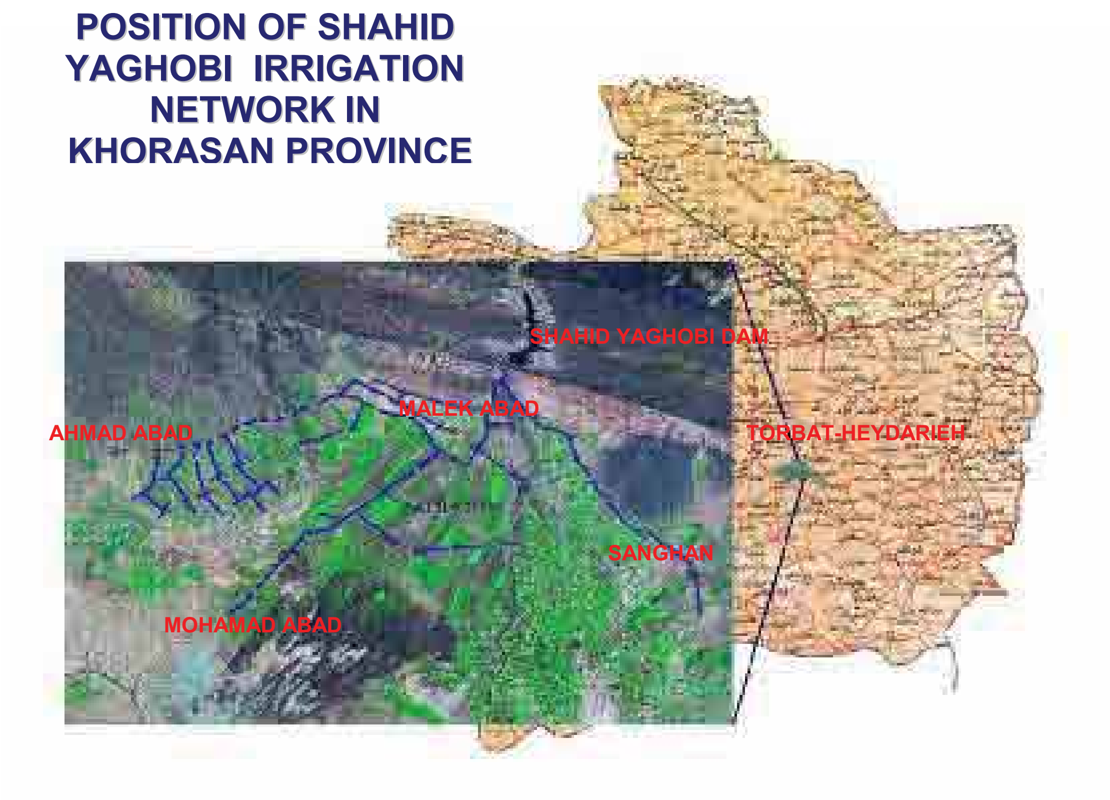
Four villages, named; Ahmad abad, Mohammad abad, Malikabad, and Sangan are located in this region.

The area of the lands having water rights is 2810 ha, which belongs to 866 farmers, and grouped in few parts.

There are 30 groups that have water rights from Shahid Yaghobi irrigation network, comprising of persons, companies, case farms, and rural farmer groups. The main activity in the area is agriculture, in which land and water are of great importance to people. Agriculture is dignitary of the economy of the family in the network area. The order of operation in these four villages is on the basis of petty land ownership, and water rights of each village from the dam is the amount previously taken from the Kal-e-salar river plus extra water purchased.

1- TOOSSAB Consulting Engineers Company

The major land owner of the region is Astan-e-Ghods Razavi. Most of the farmers have participated in the construction of the main irrigation network canals by receiving a loan.



2- OBJECTIVES:

- Design of minor network, considering water users opinion.
- Empowering the villagers.
- Establishment of water users associations.
- Establishment of proper grounds for negotiations between members of associations and relevant authorities and organizations.

3- METHODOLOGY:

This is done through field methods and negotiations with managers and experts involved the project and farmers of the region, using participatory rural appraisal methods and techniques in villages based on principles of theoretical modern approaches of participation.

- Field visits
- Negotiations with project's managers and experts

- Holding participatory workshops in villages and negotiation with people to reconsider problems, finding solutions, introducing project's objectives and accomplished works, explaining the activities necessary for utilization of available resources and facilities, consideration and comparison between orders of concentrated planning, and participatory rural appraisal, causes of foundation, background and evolution course, methods of participation, national and international experiences of public participation in management of resources, directing the negotiations towards establishment of farmers and water users associations, motivating people to take responsibility and participate in local society affairs.

3-1- WORK PROCEDURE:

- Attending meetings in villages;
- Inviting people to attend the workshop;
- Talking to participators about their life and activities in the villages;
- Finding problems and their prioritization;
- Providing proper solutions;
- Finding executive mechanisms to solve the problems;
- Derivation of problems and considering orders of state planning, and participatory rural appraisal;
- Reviewing the reasons of establishment of participatory rural appraisal planning methods and its history and its evolution course in Iran and in the world;
- Talking about the reasons of attendance of participatory working groups in villages and absorbing attention of attendees for participation in conversations, and making appropriate decisions to consider problems and how to work as a group to solve them.
- Field visits of Irrigation networks
- Creating proper grounds to establish farmers and water users associations.
- Talking about completion of irrigation network and construction of minor networks with the participation of the government and villagers by using bank facilities and preparing the people to supply some of the money required in this regard.

3-2- THE PROCEDURE

The workshops held in villages within the project area were carried on as the jollowing; Establishing close and friendly communication with the participators, aborbing their attention into topics discussed, and using the working tools such as; A0 size papers and large sized pens to practice participation methods and problems, solutions, maps, layout plans of the farms and conventional irrigation networks were recorded on those papers.

Some part of work was done by the group providing facilities, and the remaining part of the work by the participators themselves. Through practicing these methods, the villagers were able to think about their own and group problems and learn how to solve them.

During the workshops, participators could provide their opinions, paving the way of participation in future decision makings and implementation of activities.

4- AHMADABAD VILLAGE:

The work procedure in Ahmadabad village included the followings;

- Participation of villagers, especially farmers in the workshop.
- Obtaining trust and confidence of villagers through sincere negotiations with them.
- Stating their own and group problems;
- Provision of appropriate solutions to remedy problems by the villagers;
- Preparation of irrigated lands and water wells layout by participators;
- Negotiations about effective role of farmers in progress of construction of irrigation network project;
- Guidelines of participation of farmers in preparation of plans and implementing projects;
- The reasons why and how to form water users organizations and selection of its board of directors.
- Arrangement and compilation of scope of services of water user organizations.

4-1- SOME COMMENTS OF FARMERS REGARDING THEIR PROBLEMS ARE;

- Always we have been forced to do something, as, at the time of lands improvement plan, the lands were transferred to us by force and now, they are going to take it back.
- We are unable to pay installments for water shares we bought.
- 200 farmers have got 15 million Rials loan from the bank for construction of Shahid Yaghobi dam. At the present, considering that no water has been given to us from the dam, the recent draught has deprived us to pay our installments.
- Previously all villagers had water shares from Kal-e-Salar River, but now, we have to buy needed water for our lands from the dam.
- By construction of the dam, it was agreed that the farmers can use the water of the dam till their first income from their products to pay their installments, but Khorasan Regional Water Authority forgot his promises.
- Khorasan Regional water authority do not permit us to bore any water well and the region is restricted for this purpose.
- As we have got a loan from Agriculture Bank and we are due to pay it, we can not get a loan again to electrify our water wells.
- Water fees are high.
- Although we do not use water from the dam, we have to pay annually 340,000 Rials to guard the dam.
- If the dam water is ours, then why they are selling it to the others.

4-2- PROVISION OF APPROPRIATE SOLUTIONS:

In the second meeting, participators were asked to find out appropriate solutions with the help of experts. The statements concerning proposed solutions by the farmers are as the following:

- Water authorities should give us permission to dig wells.
- Our water rights shares should be given completely; otherwise, our losses must be indemnified by water authorities;
- Water authorities should show us the proper procedure to pursue.
- Our loans must be postponed and Agriculture Bank would not ask for extra Interest for repayments;
- Water authorities must solve our loan problems with Agriculture bank;
- The interest of late installments should be postponed.
- Water rate should not increase;
- Hygienic problems of public baths should be considered seriously.
- This problem would be solved by digging water wells.

- Water authorities may help us to solve our water deficits.
- Lands having no water are useless, so, water problem must be solved.

4-3- PREPARING AGRICULTURAL LANDS LAYOUTS:

At this stage, participating farmers in the workshop draw layouts of farms based on field parting and 40 group ownerships, and the leader's name of each group was noted for each land piece. In this way, it was noticed that there were 200 land owner farmers divided into 5 groups of 40 farmers; Mean-while, reminding plan's aims and the necessity of participation and cooperation of farmers in rural affairs.

They have been told that cadastre maps of their farms will be prepared very soon if they provide accurate information to surveying team to maximize the precision of maps, and to minimize the problems of determining lands ownerships.

4-4- COMPILATION OF FUNCTIONS OF RURAL ASSOCIATIONS:

As mentioned before, the main obligations of these studies and practicing participation methods in villages locating in the project area, are to establish associations and empowering people to accept responsibilities gradual transfer of affairs relating to operation and maintenance of irrigation and drainage networks to them.

In this regard, it was tried to obtain such results through practicing participation methods.

At the end of discussions, the villagers introduced 5 persons, all of them being leaders of farmers groups, as their representatives of association.

These representatives, in reply to the farmers confidence, and through various methods, considered all aspects of the work and activities and compiled their scope of work.

5– CONCLUSIONS AND SUGGESTIONS:

Implementing the 1st stage of land improvement, country's rural management underwent changes in different aspects. Before that, the village which was considered as a natural, economical, social and cultural unit, was managed under supervision of the owner or his representatives.

Presence of the government in villages to cover absence of the owners management by establishment of organizations such as; cooperative societies, …, has not been successful in bringing villages in order based on customs and legal conditions, and faces with different problems everyday.

Considering the presence of about 67000 villages in the country, the government is unable to help socio-economical development of villages to fulfill their needs. Therefore, transferring jurisdictional affairs to people and avoiding these matters by the government, and consequently, estimating acceptable social advancement of the project, will clearly define the role and importance of participatory activities for the authorities. Indeed, It is required that the government supervise implementation of the work without involving itself directly.

As we concentrate on an approach of public participation and rural matters, planning would be highly technical and pivoted on human resources. Therefore, the most important function is to prepare appropriate conditions to involve in projects creation and integrated planning by local and regional authorities and people. Even, it is required that, an expert of participatory methods come to the village to guide people at least once a month.

At the end, it can be concluded that, rural points are considered as the focus points where special facilities and amenities should be settled there to create a base for stimulation of other regions. Accessibility of proper and effective services, sustainable development gradual social discipline and proper training among the villagers are vital.

PARTICIPATORY MEASURES IN IRRIGATION- A CASE STUDY OF INDORE MINOR IRRIGATION TANK

Er.Pradeep S. Bhalge[1], Mrs.Charu Bhavsar[2]

ABSTRACT

The India was ruled by various dynasties and all of them were very much particular in promoting the Rain water harvesting and irrigation development. They were providing financial aids for construction of water harvesting devices. But they never interfere in the water management. Repairs and water management were totally in the hands of the community. But in the present days the water resources are the properties of the Government. Potential to the tune of 3.812 million hectares are created in Maharashtra. But there is wide gap between the creation and utilization of irrigation potential. The government is responsible for repairs, maintenance and water distribution. Due to which the peoples lost their affection to the water resources. Their participation in water management goes on reducing. The efficient and traditional community managed systems were being pushed in the verge of extinction. Peoples are again reviewing participatory irrigation management approach and implemented very successfully. Indore Minor irrigation tank (India) is one of them. This paper gives the details of their fantastic ideas about Participatory irrigation approach, rain water harvesting, and equitability in distribution, adoption of the advance irrigation method, and efficient use of harvested water.

INTRODUCTION

Maharashtra is situated in the southwest of India. The total geographical area is 30.8 million hectare, out of which 22.50 million hectares are cultivable. At the end of year 2004, 3.812 million hectares irrigation potential is created by harvesting the rain water. The harvested water are stored in various reservoirs. But the state lags in utilization of potential created. The gap between the potential created and utilization is increasing day by day. There is urgent need to adopt improved water policy and advance irrigation techniques to bridge the gap between the potential created and utilized. Agriculture has been the prominent occupation to provide foods and fibers to the growing population of the state. The state economy is dependent upon the agriculture production. Irrigation

1- Irrigation Engineer and Executive Council member of Indian Council For Water and Culture, Aurangabad, Maharashtra, India. pradeepbhalage@yahoo.co.in
2- Indian Council For Water and Culture, Aurangabad, Maharashtra, India. charubhavsar@yahoo.co.in,

facility is regarded as the key element of irrigated agriculture, the modern agriculture and irrigation practices play a key role in alleviating rural poverty.

The water resources, reservoirs, distribution systems etc. are the property of the Government. They are wholly governed by the Government. The rain water harvested in the reservoir is released as per the availability and demand of the beneficiaries and water tax is collected from the users. Maintenance and repairs of the head work, distribution net work up to the outlets is the responsibility of the governments and maintenance of the net work below the outlets i.e. field channels, water courses are the responsibility of the farmers. The farmers do not take part in maintenance work of the distribution system. They fills that it is the responsibility of the government only. The water taxes are so meager that, it can not be sufficient to maintain the schemes. Due to low maintenance the conveyance losses goes on increasing, this result in to the lower down the utilization.

PURPOSE

The government comes to the conclusion that without farmer's participation efficient water utilization is not possible. To improve the performance of irrigation sector, Government has promoting the users participation, water awareness and capacity building. Under this program, Number of water users associations is being formed under the command of irrigation projects. In many cases the water management is handed over to them. A case study of Jai Malhar water users Association, Indore village, Nasik district of Maharashtra State [India], is taken to review of the success of the implementation of the reformed policy and the efficient use of the harvested water.

PRESENT WATER ALLOCATION

In Maharashtra state, water is allocated on the basis of the designed crop pattern, the demand of the farmers, and availability of the water in the reservoir. The water is released on the basis of the sanctioned crop area in a given season. The quantity is to be releases at fixed interval to satisfy the crop water demand, but in actual practice the quantities and rotation period is fluctuates, since water is charged on area basis, farmers do not irrigate in night time. There is uncertainty in water supply. Water charges are levied according to the area irrigated and not on the volume of water supplied to the field. due to which tendency to use excess water is developed among the farmers. These results in deep percolation losses, leaching of fertilizers below root zone, run off at the end of borders and furrows, water logging and salinity. The present water application methods are not efficient, though they are adopted over large area in command of irrigation projects thus reduces the efficient use of harvested water. The reasons for this type of irrigation practices are,

1. There are no incentives to the farmers for efficient water use.
2. The farmers do not worry about the wastage of water, as they are not to pay on volumetric basis.

3. The rotation of water supply schedule is not implemented as it is planned on paper.

Therefore the beneficiaries will try to tap as much water as possible, when their turn is on. The head reach farmers apply excess water, while the tail reach farmers do not get water at all. In the night time some of the farmers diverts the irrigation water in to the drain, they are not penalized. The field channels are not well maintained as the farmers are not organized to share the water as their responsibility. The flow rate in each chak (Piece of land under command of one out let) is standardized as 30 Liter per second. But in most of the cases the out lets do not have discharge more than 10 liter per second. The present water policy does not permit farmer to let water in to the well. All above features drives the farmers mind to apply maximum irrigation water.

The present water distribution practices do not allow a farmer to irrigate more area in the same quantum of water. On the other hand he will be penalized for irrigating more area than the sanctioned area for growing the crops. The water demand is vary from out let to out let. The flow time vary from one day to seven days. It is very difficult to regulate the flow rate in the main irrigation canal. Thus the operational schedule gets disturbed. The end result of this type of operation practice is heavy water losses.

REFORMED WATER POLICY

As the area under the command of an irrigation managerial staff is large, it is difficult for them to maintain and keep watch on each and every field. Thus Maharashtra Government has decided to hand over the command area to the beneficiaries. The water users associations (WUA) of the beneficiaries are now formed. The command area is being handed over to the WUA. In some cases the formalities are completed. Water will be released to them on volumetric basis. Overall distribution, controlling and management of irrigation, maintenance is done by water user association.

BENEFITS OF WUA

1. Freedom of crop planning
2. Conjunctive use of water is allowed
3. Flexibility in water scheduling
4. Freedom of water distribution
5. Saved water can be use in the next season
6. Efficient water use
7. Equitability in water distribution
8. Quickly setting of the conflicts.

A CASE STUDY

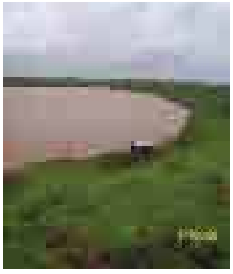
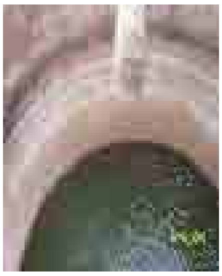
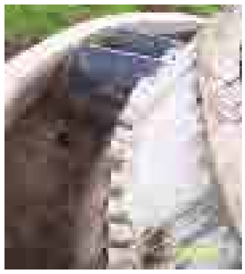
The Indore village is situated 25 Kilometers away from the district head quarter Nasik, Maharashtra (India). The monsoon rain fall occurs in month of June to mid of October. After the monsoon rains are over, it was nor possible to raise the crops without supplementary irrigation. In the summer days the peoples were neither getting water for irrigation nor for drinking. To overcome the water crises problems, in the year 1972, Government has constructed one Percolation tank of 0.45 Mm^3 capacities. In the period 1989-1992, the government has taken a decision and converted this percolation tank in to a Minor Irrigation tank. For that purpose the height of the dam is raised. Thereby the storage capacity of the tank is increased up to 0.89 Mm^3. Two irrigation sluices one at the left flank and one at the right were installed. Thus 100 hectare irrigation potential is declared to be achieved. Villages under the command are Indore and Madakejamb.

The tank never get fill with water since its construction. It was governed by the irrigation Department, Government of Maharashtra. The maintenance, repairs and operation was done by the Irrigation staff working under the government. The irrigation was done in the Rabi seasons only i.e. October to February. The tanks could not have water to irrigate in the hot weather. The tank gets empty in two or three irrigation rotation. More than 15 Acres of land can not be irrigated by letting the water in to the canal since its renovation. The tail enders never gets water. As there was acute shortage of water, the farmers were raising crops like Millet, Green gram, Black Gram etc in the rainy season. And crops like Wheat and Gram in the Rabi season. Due insufficient and uncertain water supply from the reservoir, the yields of the crops were not enough. As agriculture was the only source of income, the farmers were getting more and more poor day by day.

To over come the problems the beneficiaries united to gather. After lot of discussions and brainstorming following decisions are taken by them.

1. Decided to form water users association to take over the management of the irrigation in to their hands.
2. To reduce the conveyance losses, decided to adopt pipe distribution net work only. For that they have taken the decision to close the irrigation sluices.
3. Group of 3 to 7 farmers having fields side by side or at convenient are to be formed. Each group will laid a common PVC Pipe line to carry the discharge form the distribution chamber to the secondary distribution chamber. And every individual will laid a separate pipe line from the secondary distribution chamber to their own field, at their own cost.

They united to gather and formed a WUA named as “Jai Malhar Lift irrigation co operative society, Indore village, Nasik district, Maharashtra state (India). It is worth to know their equitable and sustainable water distribution techniques. The details are given below.

			
Indore MI Tank	Main Distribution Chamber	Peripheral Compartment On Main Distribution Chamber	Secondary Distribution chamber

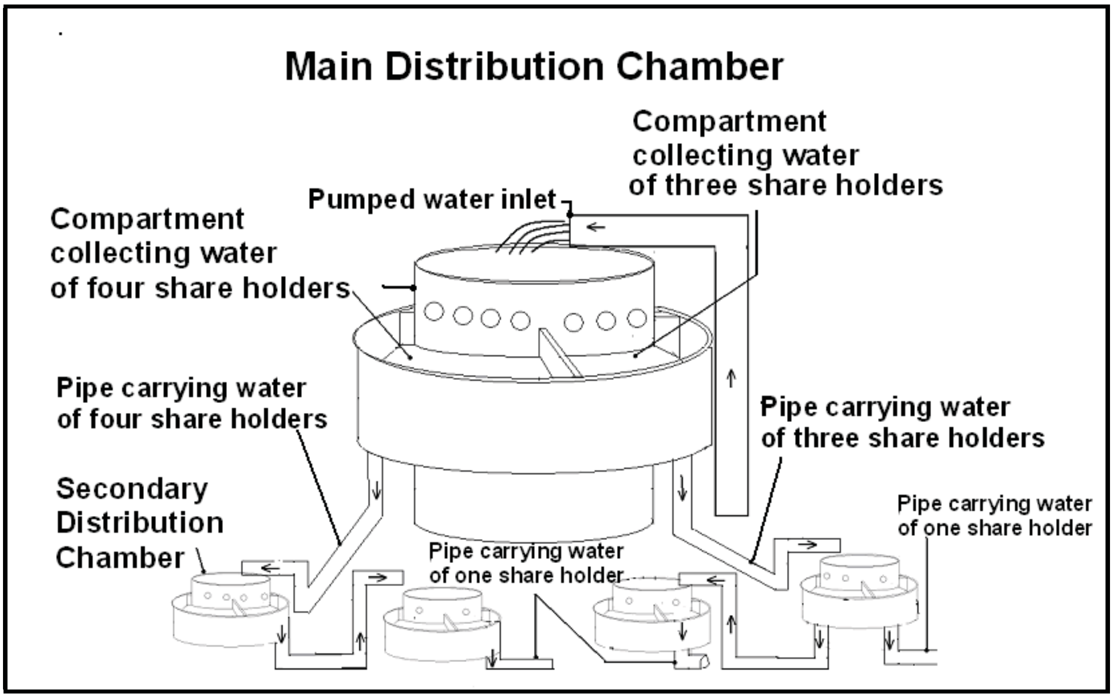


Fig 1

EQUITABLE DISTRIBUTION OF AVAILABLE WATER IN THE RESERVOIR

Total 115 no share holders are registered. A jack well of three meter diameter is constructed inside the reservoir. As shown in the figure 1, a main distribution chamber is constructed on a higher ground near the dam. Two submersible pumps of 25 HP each are installed on the jack well. The discharging capacity of each pump is 50 lps. A rising main pipe of 315 mm diameter is laid. It carries the water lifted by the two pumps, and delivers inside the main distribution chamber. The diameter of the distribution chamber is 3 meter and the depth is kept as 2 meter. 115 PVC pipe pieces of 63 mm dia and 300 mm in length are fixed over the vertical wall of the chamber. They are fixed exactly at one level. They work as out lets. There number is equal to the number of share holders.

The water delivered inside the chamber is divided equally among the all 115 pipes and flows out. Group of three to seven farmers are formed

1. When the power is on the pumps will run and the water will get collected in the main distribution chamber. From this chamber it gets distribute equally from the outlets fixed on the peripheral vertical wall. The water from the out lets fall in to peripheral chambers. The number of outlets letting water in to a peripheral compartment is dependent upon the number of farmers in that group. All peripheral compartments receive water at the same time. The water collected in the compartment is then carried through a pipe line of that group, up to the secondary chamber constructed at the common point; this chamber has one common compartment, where the water coming through the pipe line gets collected first. The vertical wall has pipe out lets of equal diameter. The number of pipe out lets is equal to the members in that group. The water coming out from each out let is then collected in individual or compartment/chamber. From this chamber the water is conveyed to the individual's field. Thus all the share holders will get equal quantum of water at the same time. As the total discharge of the two pumps is 100 lps, then it is equally divided in to 115 members, and each of them will get nearly one lps discharge over the running period. If one of the pumps is shut down, then the discharge of one pump will be equally divided among them as said above. In the existing flow irrigation systems lot of conflicts arise. But theses are avoided in this system as there are no head, middle and tail enders.
2. The maintenance of rising main and the pumps is the responsibility of the WUA.
3. The maintenance of the pipe lines is not the responsibility of the WUA. It is the common responsibility of the farmers in that group.
4. Collection of the water charges and paying it to the Government is the responsibility of the WUA.
5. As the command area of the tank is small i.e.100 hectare, only one WUA is formed on this tank.
6. Government staff of irrigation department is measuring the water level in the tank at the start and end of a cropping season. Accordingly Volume of water utilized by the Association as a whole is calculated and water charges are levied. Thus the government will get revenue on the basis of volumetric basis.
7. All the beneficiaries contributed in the cost of Construction of the rising main, pumps, elevated distribution chamber etc. Every group had made their own financial arrangements for their common conveyance. The WUA has purchased and fixed one Electric transformer of 160 KV to get continuous electric supply of required voltage. The WUA is also responsible to collect the electricity charges and pay to the respective office. It is important to note that they do not relay on the Government for the cost of the above said components.

RESULTS

After the implementation of the scheme following changes are observed.

1. The conveyance water losses are reduced to zero, thus saving in large amount of water.
2. Equitable distribution of water
3. Water is delivered to the farmers in command as well as non command area of the tank. Thus extending the irrigation benefits to the villagers.
4. Cost of pipe line is saved due to group formation.
5. Every group has a group head. He is authorized to solve the dispute among them if arises.
6. Due to involvement of people's participation, the scheme runs smoothly as the powers and responsibility are decentralized.
7. The youngsters turn to wards the farming instead of wondering for searching jobs in the Cities.
8. It becomes possible to produce export quality grapes and vegetables.
9. Able to adopt advance irrigation techniques such as Drip and Sprinkler irrigation.
10. The area under Grape is increased from 2 hectare to 60 hectare.
11. The irrigation potential is increased from 100 hectare to 200 hectare.
12. Income from the farm is increased from Rs12000 to Rs125000 per hectare.

CALCULATION OF WATER ALLOCATION

Discharge of each pipe out let	1 liter per second
Average working ours of pumps	10 hours per day
Average working days	200 days per annum
Total annual water supply to each share holder 9*12*3600*200*0.001	8640 Cubic meter per share holder
Total volume of water allocation 8640*115 (no of share holder) *0.000001	0.99 Mm^3

CONCLUSION

8640 Cubic meter water is sufficient to irrigate 2 hectares of land with advance irrigation techniques.

It is concluded that peoples participation play a very key role in sustainable development. When the beneficiaries get the filling that the irrigation system is their ownership, they do very well. This will help in following ways.

1. They will have affection to the water resources.
2. They will maintain the system in a good condition.
3. They will use the available water very efficiently.
4. The expenditure of the Government will save
5. 100 % of the potential created will be utilized.
6. Alleviate the rural poverty.
7. Achieve efficient and optimum water use with easy management.

REFERENCE:

1. Report of Maharashtra water and Irrigation Commission, June, 2005.
2. Field visit and Discussion with the beneficiaries of.Indore MIT.

PARTICIPATORY SYSTEM FOR SUCCESSFUL WATER MANAGEMENT IN THE TOYOGAWA IRRIGATION PROJECT, JAPAN

Satoshi Kono[1], Tassanee Ounvichit[2], Wataru Ogawa[3], Atsushi Ishii[4], Masayoshi Satoh[5]

ABSTRACT

In principles, Participatory Irrigation Management (PIM) means the involvement of irrigation users in all aspects at all levels of irrigation management. In practice, all over the world efforts are being made to realize the principles. However, in the execution of PIM, role sharing between farmers and government is a serious problem, and thus a clear method and ideas are needed to improve PIM. In particular, a broad discussion of role sharing is demanded. This paper illustrates how the Japanese way of role sharing in PIM is realized based on the case of the Toyogawa Irrigation Project in central Japan. Organizationally, the project is jointly managed by five entities, including both the public sector and the farmers' organizations. These entities have clearly divided their functional roles in irrigation management, with the ultimate decision power in all aspects of irrigation management given to organized farmers. The power is realized either directly or through the land improvement districts' representative system depending on the levels of the irrigation system. The public entity provides coordination support to create a transparent forum of discussion together with scientific information for farmers' understanding and decision-making. The participatory institutional line-up

1- Graduate school of Life and Environmental Sciences, University of Tsukuba, Ten-nodai 1-1-1, Tsukuba, Ibaraki 305-8572, Japan, Phone: +81-29-853-4899, E-mail: shitosanoko@hotmail.com
2- Policy Analysis Group, Planning Division, Royal Irrigation Department, 811 Samsen Road, Bangkok 10300, Thailand Fax: +66-2-669-5014, E-mail: ounvichit@yahoo.com
3- Engineer, Water Resources Engineering Department, Japan Water Agency, Shintoshin 11-2, Chuo-ku, Saitama, Saitama 330-6008, Japan, Phone: +81-48–600-6508, E-mail: wataru_ogawa@water.go.jp
4- Assistant Professor, Graduate School of Bioresources, Mie University, 1515 Kamihamacho, Tsu, Mie 514-8507, Japan, Phone: +81-59-231-9579, E-mail: ishii@bio.mie-u.ac.jp
5- Professor, Graduate School of Life and Environmental Sciences, University of Tsukuba, Ten-nodai 1-1-1, Tsukuba, Ibaraki 305-8572, Japan, Phone: +81-29-853-4648, E-mail: massa@sakura.cc.tsukuba.ac.jp

of Toyogawa Irrigation Project enables the upland areas that suffered periodically from water deficits to develop itself into Japan's major producers with a high productivity and remarkable crop diversification.

1. INTRODUCTION

A widely accepted, fundamental principle of participatory irrigation management (PIM) is that it should involve irrigation users in all aspects and at all levels of irrigation management (INPIM). However, in the execution of PIM, role sharing between farmers and government is a serious problem, and thus a clear method and ideas are needed to improve PIM. In particular, a broad discussion of role sharing is demanded.

Under the system of Land Improvement Districts (LIDs), which are farmers' autonomous irrigation associations with total responsibility for irrigation system management, Japanese water management is known as a successful form of PIM. In almost all Japanese irrigation projects, every irrigation facility is transferred to a related LID after construction or rehabilitation is complete. The LID collects its membership fee from farmers to cover all management costs. However, Japan also has some successful PIM cases, in modern large-scale irrigation projects, where farmers and a government agency (or the public sector) share in water management roles.

The purpose of this paper is to introduce and analyze the role sharing of farmers and government in water management in the Toyogawa irrigation project, which is the irrigation sector of the Toyogawa Water Resources Developing Project in Japan.

2. STUDY AREA

The Toyogawa Water Resource Development Project, which was established in 1968, is one of the most successful modern water resources development projects in Japan. It is a multi-purpose project for the management of water for agricultural, industrial, and domestic use. In the agricultural sector, this project covers 18,000 ha of farmland (paddy: 6,500 ha, upland: 11,500 ha), extending over six cities and four towns in the central Japanese prefectures of Aichi and Shizuoka. This command area includes traditional paddy irrigation areas. This paper focuses on the new irrigation areas encompassing 16,000 ha (paddy: 5,000 ha, upland: 11,000 ha) in Aichi Prefecture. We call the study area "the Toyogawa area" hereafter.

Figure 1 shows the monthly precipitation and temperature in this area. The average temperature is 16.0° C and the average annual rainfall is about 2,100 mm/year. However, dry spells in the region sometimes extend to one month. Therefore, it is impossible for farmers to realize stable agricultural production without irrigation. The project has brought not only increased productivity but also remarkable crop diversification over the upland fields of the area (Satoh 1999). Irrigation has also promoted controlled and scheduled production, which agricultural markets in large cities prefer.

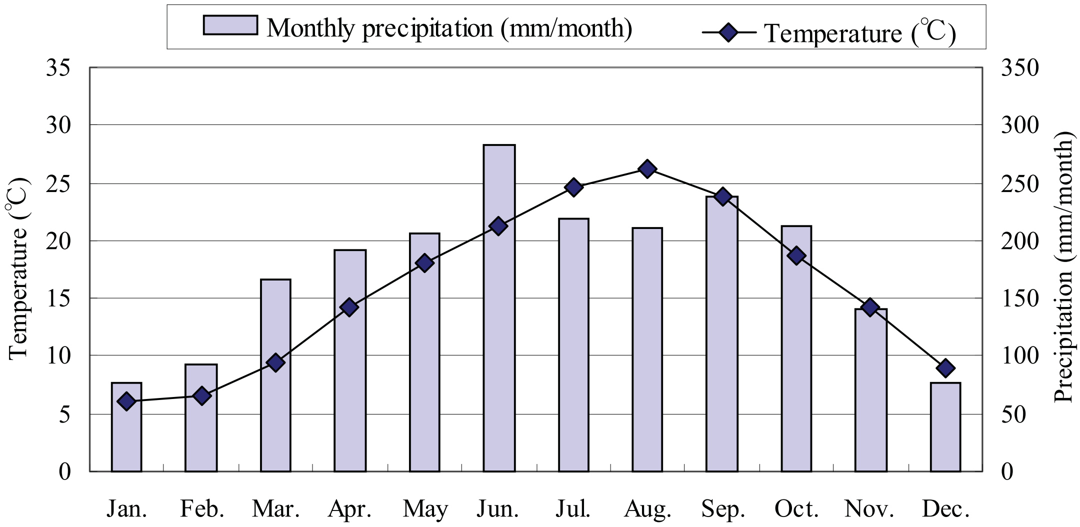


Figure 1. Monthly precipitation and temperature at the Toyogawa Irrigation Project

Figure 2 outlines the project's water resources system. The major water source is the Toyo River (total catchment area: 724 km^2), and supplemental water comes from the adjacent Tenryu River basin (total catchment area: 5,090 km^2). The irrigation system consists of the Ure reservoir (catchment area: 26 km^2, live storage: 28 MCM) and the Ohshima reservoir (catchment area: 18 km^2, live storage: 11 MCM) in the upstream of the Toyo River; the Ohno diversion dam (catchment area: 130 km^2), seven regulating reservoirs (total live storage: 12 MCM), and a canal network, which includes 2 main canals, 163 lateral canals, 296 common-use farm ponds (FPs), and 2,700 km of distributaries. The irrigation water in the main and lateral canal system area is distributed by gravity, but it is applied mostly by sprinkling systems, which consist of FPs, pumps, and distribution pipelines.

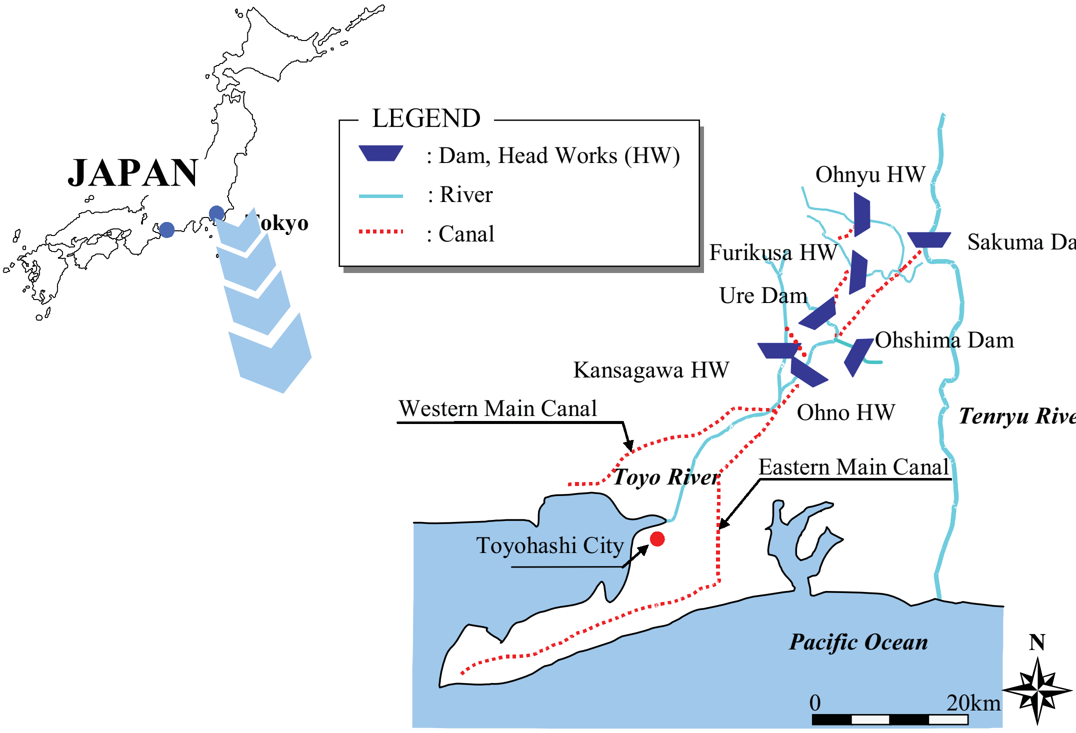


Figure 2. Outline of the water resources system of the Toyogawa Irrigation Project

3. ORGANIZATION FOR WATER MANAGEMENT

3.1. ORGANIZATIONS

Five kinds of organizations are involved in the Toyogawa Irrigation Project (Kozuki 2000): (1) the Japan Water Agency (JWA)[1], a public entity that managed the construction project; (2) Toyogawa LID, an autonomous irrigation association of farmers that is established for this project[2], having tree branch offices; (3) local LIDs, which are established based on administrative boundaries of cities or towns and which function as local water user associations; (4) Management Districts (MDs), which are established by beneficiary farmers of each FP, practically corresponding to a traditional local community of *Mura*; (5) Management Groups (MGs), which are established by three to six farmers as rotational irrigation units in an MD.

Toyogawa LID and local LIDs are farmers' autonomous irrigation associations. As they are LIDs, they employ a representative system following the articles of the Land Improvement Act (1949). The representative assembly is the highest legislative organ in

1- JWA was originally called the Water Resources Development Public Corporation.
2- When the Toyogawa Irrigation Project started, the farmers' organization for water management of the whole project was an integrated body of local LIDs, which was later reorganized as the Toyogawa LID.

an LID. Representatives are elected from electoral districts by local farmers, each of whom has an equal vote. Every farmer in this project belongs to both types of LIDs (**Figure 3**).

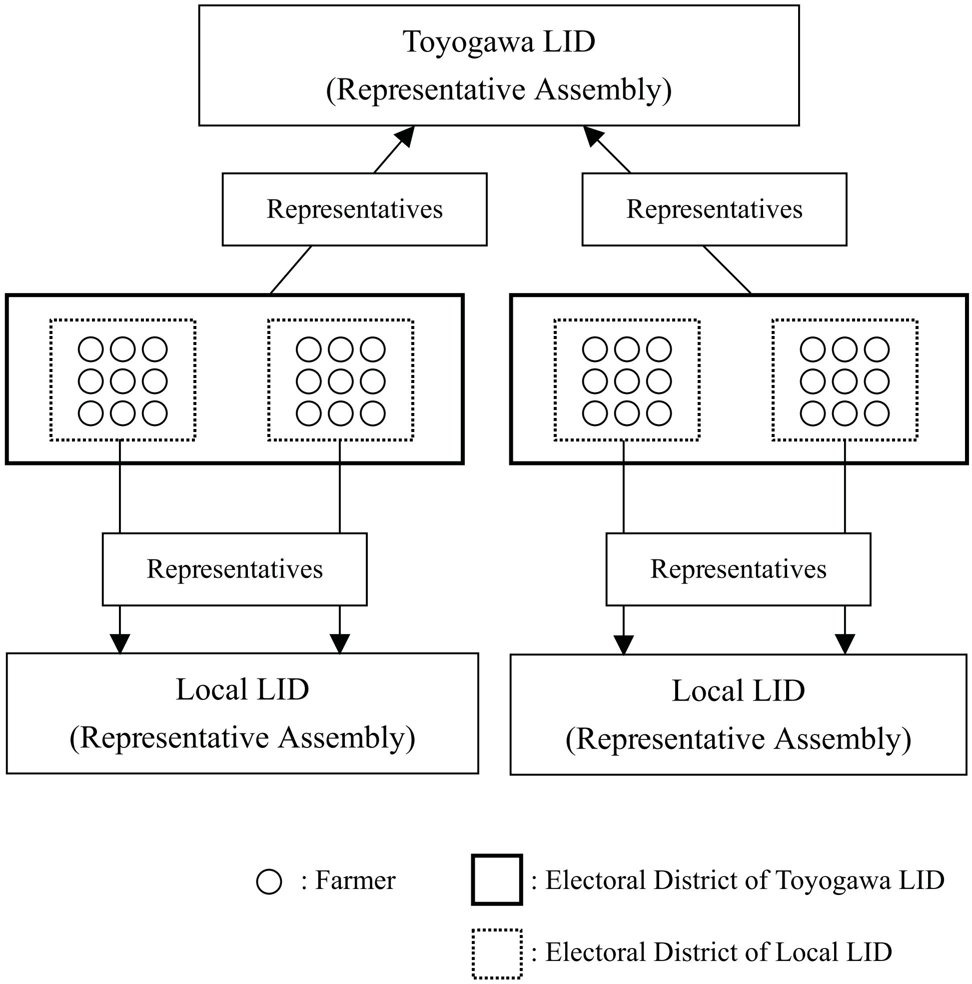


Figure 3. The relationships between farmers to Toyogawa LID and Local LIDs

3.2. DEMARCATION IN FACILITY MANAGEMENT

These organizations demarcate their roles in water management according to the level of a facility, from main to on-farm. JWA manages the main parts of an irrigation facility: water resource systems (reservoirs, diversion dams, regulating reservoirs) and main canals. It is responsible for delivering water to lateral canals.

The Toyogawa LID manages lateral canals and sends water to FPs. Toyogawa LID staff patrol FPs to check on stored water daily, and they readjust allocation of water to lateral canals as needed.

Local LIDs, MDs, and MGs manage FPs and on-farm facilities in a group. MG leaders in a MD adjust water demand each other. The MD representative designated by local LID has a capacity to operate valves to send water from FPs. Only MD representatives have this authority; other farmers are not allowed to adjust water distribution. Local LIDs compile requests from MDs and request water from the Toyogawa LID according to necessity.

3.3. MANAGEMENT COST

All costs for water management in the Toyogawa Irrigation Project, including the JWA, the Toyogawa LID, and the local LIDs, are covered by the beneficiary farmers. The Toyogawa LID helps JWA collect money from farmers. The membership fees are based on acreage as well as on the land use of paddy or upland fields.

4. WATER ALLOCATION PLANNING

4.1. IMPROVEMENT PROCESS

Originally, the water distribution method that was applied to the project is shown in **Figure 4**. The water demand was calculated fully based on the declared daily irrigation area by farmers. The total area of irrigation was conveyed through the LID's hierarchical system, converted to a flow rate, and forwarded to the JWA.

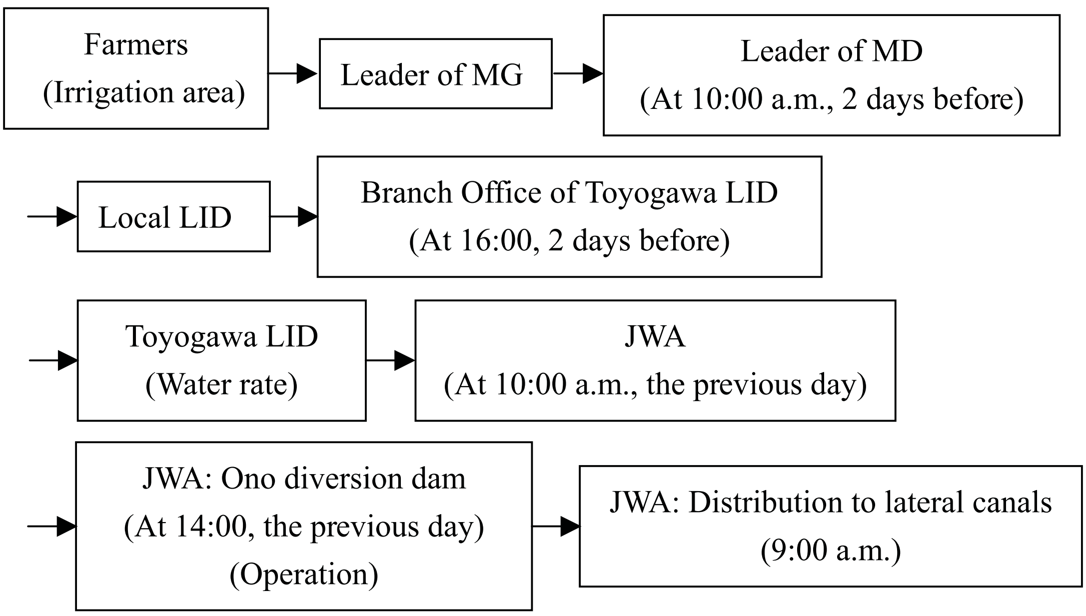


Figure 4. The original water allocation method and distribution process

This system was applied to promote the development of irrigated upland agriculture in this area; it supplied enough water to satisfy farmers' needs. It also realized crop diversification in extensive way. However, it required two whole days to send water to lateral canals after farmers' requests. Under uncertain weather conditions, it is difficult for farmers to precisely decide the area to be irrigated two days in advance. Therefore, to avoid risk, farmers requested more water than they thought they would actually need. This resulted in high water demand and low irrigation efficiency. It caused frequent water shortage problems even though the water demands of other sectors had not yet developed to the designed levels (Satoh 1973).

The water allocation and distribution system was improved to avoid this complicated procedure and the problems it induced. In the new system, the first four steps in the previous system are skipped and Toyogawa LID branch offices take the first step to request water as on behalf of farmers.

JWA, the prefectural government, and Toyogawa LID discussed the water allocation plan when an improvement project started in 1980. As a result, a pattern of a standard demand rate (SDR) for each lateral canal was developed based on the water distribution record during 1978 to 1980 (consecutive water shortage years). This record was regarded to reflect the actual water demand in each lateral canal. Since then, the SDR has been used as the water allocation basis.

Crops and cropping patterns have been changing in different ways over the area, and a discrepancy developed between actual water demand and the SDR. Therefore, SDR was reviewed during a discussion of measures against water shortages in 2002. A new SDR was made for every ten-day period based on farming area and crops. The revised SDR better matches to farmers' actual demand now.

As mentioned above, the water allocation plan has been changing. However, it should be noted that the plan is discussed and decided principally based on farmers' demand, with farmers participating through the LID system.

4.2. PRESENT PROCEDURE FOR ANNUAL WATER DISTRIBUTION PLAN

The representatives of local LIDs gather in the Toyogawa LID branch office every year to discuss and adjust the annual water demand. Toyogawa LID compiles these demands and submits them to JWA. JWA and Toyogawa LID then discuss the annual water allocation plan in consideration of applied demand and SDR. Upon approval by the president of the Toyogawa LID as well as by other water sectors, the annual water allocation plan is finalized. Thus, JWA doesn't decide the plan in a top-down manner.

Toyogawa LID employs a representative system and the directors are elected in a representative assembly, which selects the president. Therefore, the president's approval in the final stage of the process can be regarded as approval by all farmers in the hierarchical representative system.

5. MEASURES AGAINST WATER SHORTAGE

The Toyogawa project area has been experiencing water shortages rather often: 28 times in the past 38 years. JWA has established the Water Saving Committee (WSC) to discuss and decide measures against water shortage. The main discussion in the committee is to what extent water saving ratios should be applied to the different water sectors and when their application should be started or changed (intensified or loosened).

The WSC consists of 14 people. Two of them are the staff of JWA, and others are representatives of related organizations: Seven people are from four related LIDs, and the remaining five are from two prefectural governments representing the water supply sector, the industrial water sector, and some other farmers in Shizuoka Prefecture. Thus the representatives cover all beneficiaries in the project. WSC is chaired by one of the staff members of JWA. The secretariat of JWA compiles records of river discharge, water storage in the reservoirs, expected future water demand, meteorological forecasting, etc., and presents all the data necessary for discussion to the committee. The secretariat also proposes measures against shortages to the WSC if required.

In case a water conservation operation is performed, especially when the ratio is very high, the local LIDs supplement the water supply by operating wells that have been developed for emergencies. The distribution of the wells is not uniform over the command area; some lateral systems include many wells, while others contain few or no wells. Therefore, a local LID will adjust the water allocation to lateral canals from the Toyogawa irrigation system so that all members of the local LID receive an equitable amount of water. This shows that local LIDs have developed a sense of unity among them. The lower-level farmers' organizations, MD and MG, have the same quality.

6. DISCUSSION

There is an idea that water management can be better understood if it is divided into four processes: Decision, Operation, Monitoring, and Feedback (Satoh, 2003). Based on this idea, the role sharing between JWA and farmers in the Toyogawa project is discussed.

(1) DECISION PROCESS

When deciding matters related to water management plans such as SDR, annual water distribution, or measures against water shortages, JWA convenes a meeting or begins a process in which all interested organizations are invited to participate. In this meeting, interested organizations discuss, adjust, and decide, while JWA provides scientific and technical knowledge and guides the meeting to rational and fair discussion. Thus the roles of JWA are coordinator, adviser, and chair, while water users act as decision-makers. The most important thing is that not only interested organizations have decision power but JWA (the government) assists them to enable them to decide rationally. This system can be called functional role sharing (FRS).

In addition, Toyogawa LID and local LIDs are farmers' autonomous irrigation associations. As they are representative systems, every important matter is discussed and decided in a representative assembly. Representatives compile local farmers' intentions and demands, so every farmer can participate in decision-making through the representative system. In other words, every farmer has decision power through the hierarchical system.

The role-sharing between JWA and the interested water users' organizations in WSC, which is a discussion table for decision-making, is clear. The roles of JWA are: (1) to convene the WSC (coordinator), (2) to provide scientific and technical knowledge for rational discussion and decision-making (adviser), and (3) to chair the meeting to finalize plans (chairperson). On the other hand, the role of farmers' Delegate is to discuss, adjust, and practically decide. Considering the composition of the participants, it is clear that water users hold the deciding power in WSC.

(2) OPERATION PROCESS

JWA, Toyogawa LID, local LIDs, MDs, and MGs form a hierarchical system corresponding to facility levels, and operate in an environment of spatial role-sharing (SRS). In this environment a directly interested organization is not allowed to operate by itself, but a higher organization operates instead. In this way, it is easy to distribute water in a fair and neutral way. For example, the water allocation to each lateral canal is decided by beneficiary farmers, but the operation is done by JWA staff. Water distribution in lateral canals is operated by the staff in a regional office by the staff of Toyogawa LID.

It is difficult for farmers to operate modern large-scale irrigation facilities, since special knowledge and skills are needed. On the other hand, staff members of JWA cannot manage every facility at the on-farm level by themselves because of limited resources. Therefore, role sharing in the facility operation of a large-scale irrigation project is inevitable. Methods to maintain fairness in operation have been crucial for maintaining farmers' satisfaction with the project.

(3) MONITORING PROCESS

JWA disseminates information on the state of water resources by several means, such as its website or by providing information directly to related organizations. A bulletin periodically distributed to every member farmer can also support farmers' understanding of the state and functions of facilities. Everybody can see the state of water distribution at FP or at a spillway.

The staff of the Toyogawa LID branch office is responsible for distributing water down to FP, but they also go and observe water conditions in the field and adjust water distribution accordingly. In a formal procedure, a local LID and MD are supposed to inform the Toyogawa LID branch office about what they observe. However, they tend not to inform the Toyogawa LID branch office if there is more than enough water, while reporting urgently when water is short. In this way they watch each other, and suspicions of unfair or irrational operation are swept away. The staff of JWA, of course, watches farmers to prevent selfish actions at the lateral gates and other facilities. Since water distribution is well monitored, any selfish action would be easily revealed.

In addition, as every farmer has participated in the decision process for water allocation, not directly but through a delegate, any selfish behavior would be blamed not only by other group members but also by his colleagues.

(4) FEEDBACK PROCESS

As mentioned above, monitoring and feedback processes occur simultaneously for the water distribution within a lateral canal system. Water between laterals can be adjusted as a result of discussion at a local LID. If a serious water shortage occurs, the growth stages of the affected crops are considered, and the priority would be placed on critical crops, thus avoiding serious damage and higher profits in that district.

On the other hand, it is not easy to adjust water allocation among local LIDs, especially during times of serious water shortage. Differences in cropping schedules have already been considered in making the SDR. However, the WSC is always watching the state of water resources, so its can properly change the water saving ratio according to the continuation of a drought.

7. CONCLUSIONS

The Toyogawa Irrigation Project is one of the most successful in Japan. It has achieved not only increased production but also extensive crop diversification over the beneficiary area of the upland irrigation. It is based on the principles of stable irrigation management and the full participation of farmers.

The project is managed by the Japan Water Agency (JWA). However, the farmers have developed the Toyogawa LID for the project as well as local LIDs for every region of the project area, which hierarchically includes Management Districts (MDs) and Management Groups (MGs). These five organizations share water management roles based not only on the levels of canals but also on the steps of the water management process: Decision, Operation, Monitoring, and Feedback.

Special attention should go to the fact that decision-making power is practically given to farmers at all levels and in all aspects. Water management plans are decided in meetings attended by all delegates from different interest groups, and JWA merely guides and supports the discussion by providing scientific and technical information. On the other hand, water allocation operations are performed by JWA staff to strictly implement what has been decided in the meeting. As a result, JWA can realize equitable water sharing and high irrigation efficiency, which are goals of the government, with minimal effort.

The main points for the successful water management of the Toyogawa Irrigation Project are (1) participation of farmers in the decision process at all levels, (2) farmer organizations for the project that give every farmer the opportunity to express his opinion, (3) a Functional Role Sharing (FRS) system in which related organizations play their roles in the four functions of water management at each canal level.

REFERENCES

1. INPIM: http://www.inpim.org/leftlinks/FAQ/Topic%20Page/PIM
2. Kozuki R. 2000: Japanese case, pp. 199-202, in “Management of irrigation systems” (in Japanese), Kuroda Ed., 374 pp., The Japan Association for Irrigation and Drainage Mechanization, Tokyo
3. Satoh, M. 1973: Study on the development of the Toyokawa Irrigation Water System and the agricultural development III. The problems of the water management of the Toyokawa Project (in Japanese with English abstract), Research Bulletin of the Faculty of Agriculture, Gifu University, 34, 257-267
4. Satoh, M. 1999: Crop Diversification in the Toyogawa Irrigation Project, Japan, 17th Congress on Irrigation and Drainage, Transactions Volume-1G, 69-76, Granada, Spain
5. Satoh, M. 2003: Principles for Participatory Irrigation Management by Organized Farmers, Keynote Speech at The 3rd World Water Forum JBIC-JICA Session, The Report “Sustainable and Efficient Use of Irrigation System & Water, and Farmers’ Participation” pp. 1-9, Kyoto International Conference Hall

THE NECESSITY OF PARTICIPATORY MANAGEMENT IN WATER SECTOR IN IRAN

A.A. Karami[1], K. Mohammadi[2] and H.R. Najib[3]

ABSTRACT

During the past decades, most of the investment, construction and management of the water projects in Iran have been the responsibility of the government, and the private sector had little influence in this regard. This policy of the government has caused the water projects to become less successful and have low efficiency, despite the large amount of the investment. In order to overcome some of these problems, the government passed several laws to attract the participation of farmers in development and construction of irrigation and drainage networks. This movement was the beginning of the official participation of farmers in the water sector in Iran and it proved that despite the difficulties of implementation of the program, it was successful in overall. Therefore, it is necessary to develop a mechanism to have more involvement from the farmers in different levels of projects including decision making, design, construction, operation, and maintenance.

In order to achieve such objective, a proper structure and organization are needed in governmental agencies, investment institutes, and farmers associations. These components of the participatory management and responsibility should be well defined. Practical laws, methodologies, and instructions are necessary to achieve the objectives of the program. In this paper, the proposed structure of the farmers' participation in water sector is explained.

Key words: participatory management, farmers associations, irrigation management transfer, privatization.

INTRODUCTION

Rapid irrigation development has taken place throughout the 20th century, with increasing levels of public finance through the post-war period, aimed at the full

1- Director of the Farmers Participation in Irrigation development Plans, Ministry of Energy, Tehran, Iran.
2- Assistant Professor, Tarbiat Modarres University, P.O. Box 14115-336, Tehran, Iran, kouroshm@modares.ac.ir
3- Integrated Natural Resources Officer, FAO: Sub-Regional Office for North Africa, Tunis, Tunisia, reza.najib@fao.org

spectrum of gravity-supplied irrigation and groundwater exploitation. Despite the success of irrigation in supporting the Green Revolution, irrigation schemes have often under-performed in economic terms, and field research has highlighted substantial shortcomings in management (operation and maintenance), equity, cost-recovery and agricultural productivity. Reasons for this include:

- Unrealistic productivity projections at appraisal;
- Capital cost over-runs;
- Substandard construction or design;
- Poor system management and service provision;
- Poor understanding of farmer priorities and inadequate markets for produce.

Public investment in irrigation development tailed off from the 1980s as fiscal constraints set in and external funders became disillusioned with the economic performance of previous investments. This period has also seen a significant decline in the international prices of major irrigated crops such as rice and wheat, and diminishing marginal returns to farmers input use in intensively cultivated areas. This has contributed to reduced profitability and to the decline in external and domestic financing. Further, growing environmental concerns over the impacts and costs of large water development projects have stimulated more interest in the careful use of water than in simply increasing its supply (Turral, 1995).

Policy options in response to poor economic performance are summarized by Rosegrant and Binswanger (1994):

- Technological solutions, including rehabilitation, modernization and water conservation technologies;
- Reform of public management of irrigation systems;
- Communal water management through improved farmer participation;
- Establishment of tradable property rights in water and the development of markets in water rights.

An important and positive trend in recent years has been the increase in recognition of the importance of private sector participation in project execution and management. In the past few decades, governments have intensively involved and incurred heavy expenditure as direct assistance in the form of the creation and management of economic and social infrastructure such as irrigation systems with the aim of achieving income, employment and welfare objectives of rural communities and to enhance local food production (Turral, 1995).

Until the late 1800s, irrigation was developed by users at the village or community level using local resources (Peter, 2003). By the early 1900s irrigation came to be developed through large public agencies. The period 1950-70 saw the large-scale development of irrigation through public and donor funds. By the early 1970s it was apparent that irrigation systems were difficult to maintain due to inadequate funding of operation and maintenance (O&M), poor collection of service fees, deteriorating canals, drains and structures. They were open to rent seeking and were becoming less and less sustainable (Repetto, 1986). The period that followed (1970s and 80s) was a phase of irrigation improvement wherein the emphasis was on rehabilitation and introduction of new technologies, management techniques, training, introduction of service fees and farmer participation. At this stage a number of irrigation specialists articulated the need for a new paradigm for irrigation development as they recognized that sustainable irrigation systems require active participation of the users in order to be properly operated and maintained (Coward and Levine, 1987). By the time Government recognized the need for user participation in O&M, they were confronted with large public irrigation organizations that saw the move towards users as a challenge to their authority and power (Peter, 2003).

Participation refers to a continuum of involvement in management decisions. One meaning of participatory irrigation management (PIM) may be that the irrigation users have total control and responsibility over the operations and maintenance of part or all of the irrigation system. Another meaning of PIM may be that a farmer council plays an advisory role, with real power remaining in the hands of the irrigation agency (World Bank, 2003). When farmers are directly involved in the design process, whether for new systems or rehabilitation of old ones, they will provide useful design input and they will come away with an understanding of the design logic of the system they will be managing. During construction, farmer input has the functions of quality control (ensuring design standards are met), cost savings (through guarding against needless spending, and substituting some costs with farmers' own labor), and construction knowledge. Knowing how the system is constructed will help in repairs later on.

Management approaches in irrigation generally fall into three categories: (1) public sector management, (2) private sector management, and (3) users' organizations (World Bank, 2003). The strategies that countries have taken in implementing PIM policies may be characterized according to three basic approaches: (1) the rapid "big-bang" approach of Mexico where water users are strongly pressured to establish an organization to replace the government, (2) the "bottom-up" slow approach of the Philippines with a strong focus on organizing and consensus building, and (3) a hybrid approach which adopts a moderate pace, such as that adopted by Turkey.

The opportunities for participation are different in each phase of the project cycle. Much of the emphasis on PIM has focused on participation in O&M, and particularly in the recovery of O&M service fees on behalf of the irrigation agency. While this aspect of participation is of great practical importance, there are many ways other aspects of irrigation management where participation can be incorporated. These include: (1) participation in irrigation project identification, planning, and design; (2) participation in system layout and construction; and (3) participation in project monitoring and evaluation.

In addition to required changes in current policies, agency managers have to face the question of institutional capacity -- trained staff, budget, managerial resources -- to undertake a large scale expanded program that would cover a larger geographical area. Some time may have to be initially spent during the expansion phase in strengthening institutional capacity to manage the effort.

An important and positive trend in recent years has been the increase in recognition of the importance of private sector participation in project execution. In recent years, there has been a large increase in private sector participation in the provision of water projects. Between 1990 and 1997, the cumulative new private sector capital expenditures in water supply and sanitation projects in developing countries was $25 billion, compared with $297 million in the period 1984-1990 (Franceys, 1997). The overall level of investment in water-related infrastructure in developing countries is estimated to be of the order of $65 billion annually with respective shares about $15 billion for hydro, $25 billion for water and sanitation and $25 billion for irrigation and drainage (Briscoe, 1999).

ECLAC (1995, 1998) compared the successes and failures in promoting privatization approaches in Mexico, Venezuela, and Chile and concluded that the failures in Venezuela were due to a lack of system, which obstructed the development of proper policies (Contreras, 2000). In contrast, the privatization was successful in Chile due to the establishment of strict standards for financial reporting, similar to those of private companies, and the establishment of rigorous independent regulatory authority. Mexico has worked hard to institute a transition from centralized ownership and management of the irrigation systems to a policy of co-responsibility between the government and the irrigation water users (Contreras, 2000).

In order to use the optimum value of water resources and consequently increase the agricultural production and level of farmers life, the government of Iran believes that it is necessary to transfer the management of water sector to the private firms and groups and it can be in all levels including planning, construction, operation and maintenance.

In this paper, the proposed processes have been introduced and duties and responsibilities of each section have been suggested. It is divided into three sections as follows:

- The government responsibilities for associations, cooperative organizations, and farmers' groups;
- The groups and associations responsibilities;
- Banks and other financial institutes for providing the funds and investment facilities.

GOVERNMENT RESPONSIBILITIES

It is necessary that the government prepares the required policies for farmers' participations in water sector to transfer part or all the government's responsibilities in different levels. Although during the last two development programs some offices have been established in Ministries of Energy and Agricultural Jihad, but they do not have enough responsibility to answer the needs of this important issue. The following changes and improvements can be suggested for better deal with this issue from the government side:

DEVELOPING THE NECESSARY STRUCTURE FOR MANAGING THE TRANSFER PROCESS

In order to manage the transfer process of water management in different levels, it is necessary to have a proper organization within the government system with enough authority to enforce policies. The existing offices in Ministry of Energy and

Agricultural Jihad are not fully capable and authorized to make the necessary actions and answer today's need for this important issue.

Due to the very "public" nature of the sector, public authorities continue to have an important role to play. Rather than being a manager and provider of services, the government must serve as a regulator and a guarantor of a certain level and quality of provision. The objectives may remain the same, but the instruments have changed. In this respect, private sector may actually place more rather than less demand on effective and capable public authorities. Intervention through incentives requires more skill than intervention through investment. New regulatory capacity is required to deal with these new roles.

FORMING FARMERS' GROUPS AND ASSOCIATIONS

Transferring the water management requires a proper farmers' group. Therefore, helping farmers to develop and form their associations or cooperatives is one of the first issues that the government should consider. In this regard, Ministries of Energy, Agricultural Jihad, Cooperative (Taavon), and NGOs should have a close cooperation and develop a model and algorithm considering social, cultural and economical aspects of farmers. During the second and third development plan of the country, there have been tremendous progresses in forming the farmers' groups for participating in construction of irrigation networks. These existing groups can play an important role in transferring the irrigation services to farmers especially in operation and maintenance.

REFORMING THE POLICIES AND RULES

One of the intensives for participation of farmers' groups in water management is to transfer the ownership of the infrastructures to those groups. In some countries, such as Mexico, this transfer of ownership has been happened.

In 1992, Mexico adopted a new National Water Law (Ley de Aguas Nacionales) that introduced sweeping changes to federal water management and policy. For decades prior to the reforms, Mexican water management, agricultural planning, rural credit and urban water services had been centrally controlled by the federal government. The new law instituted the following specific modifications to national water policy:

- decentralization of management of irrigation districts from the federal government to water users themselves, via the process of "transference";
- decentralization of urban water services from federal to state or municipal control;
- removal of irrigation system subsidies equivalent to 60 to 80 % of total costs prior to the reforms;
- full-cost recovery pricing of water;
- establishment of formal markets to trade water rights;
- and introduced mechanisms to allow privatization of service provision in municipal areas and infrastructure projects in rural areas.

Beginning in 1992, Mexico initiated a massive decentralization process referred to as "transference" or "la transferencia" in its 81 irrigation districts, during which it transferred management authority from the federal government to a network of district organizations. The World Bank pronounced Mexico's transference program a success and offers it as a model for other developing countries in terms of the rapidity of the transference process itself (79 districts in less than 10 years) and due to the gains in efficiency of water use that have resulted (Easter, 1998). Based on Mexico's experience, the Bank decided to reverse its former strategy of "rehabilitate first, then transfer" to a new strategy of "transfer first, then rehabilitate," founded upon the belief that after transference, Mexican water users have been more capable of deciding democratically how to utilize scarce financial resources to modernize the water system in the most beneficial ways (Easter, 1998).

GUIDELINES AND METHODOLOGIES FOR FARMERS' PARTICIPATION

According to Note 76 from second development plan and Part A of Code 106 of third development plan and Part T of Code 17 of fourth development plan and other codes and regulations of the government, Ministries of Energy and Agricultural Jihad were appointed to provide low interest grants and funds for farmers to construct irrigation and drainage networks. Therefore, these ministries should consider the following actions in order to make the above mentioned regulations and laws practical:

- Institutional reform in different levels of the government, forming new positions and hiring professional staff;
- Introducing profitable projects to the farmers;
- Introducing the investors to the banks for using their capital and investing in the projects;
- Forming farmers' groups and associations to mange the project constructions and operation;
- Supervision of tenders and contract awards between farmers and contractors;
- Supervision of the construction process and handing over the constructed project to the farmers;
- Evaluation of the project performance during the operation.

CONTRACT BETWEEN GOVERNMENTAL AGENCIES AND FARMERS' ASSOCIATIONS AND GROUPS

In order to protect the investment of the government used in transferred irrigation, it is recommended to sign the contract between farmers' groups and government and consider the following terms and conditions:

- Ministry of Energy should provide the following services:
    - o Completion and equipping the irrigation networks to make them ready for transferring to the farmers;
    - o Supply, regulate and control the water inflow to the irrigation networks;
    - o Evaluation of operation and maintenance performance of the cooperatives or associations;

  - o Continuous support of farmers' groups financially, technically, politically, etc.
- Ministry of Agricultural Jihad's services to the farmers
  - o Land leveling, integrating and rehabilitation of farms;
  - o Transferring agricultural services to the farmers' cooperatives;
  - o Support in building silos, fridges and food processing industries;
  - o Insuring agricultural products;
  - o Helping farmers in marketing and selling their products;
  - o Continuous support of farmers' groups financially, technically, politically, etc;
  - o Resolving disputes between farmers.
- Ministry of Cooperatives
  - o Making new policies, regulations and constitutions for cooperatives;
  - o Fund raising from public and governmental sectors for cooperatives;
  - o Educational, cultural, technical and scientific helps to cooperatives;
  - o Organizing and managing the technical, financial and administrative helps from other organizations;
  - o Providing necessary facilities to develop the cooperative activities;
  - o Providing facilities to the farmers to be able to export their products;
  - o Providing conditions for cooperatives to invest their capital;
  - o Developing the necessary guidelines and regulation for banks to grant funds to the cooperatives.

FARMERS TRAINING

Since in the proposed model, farmers will be responsible for transfer and distribution of the irrigation water, it is necessary to train those who are responsible for this job. Therefore, the consultant companies that are designing the project should consider the simple methods for operation and maintenance of the networks and train farmers during the construction phase. In addition, after handing over the management of the irrigation network to the farmers, consultant should supervise the performance of the farmers to make sure that the network is operated at the optimum level.

RESPONSIBILITIES OF FARMERS' GROUPS

Farmers' groups in any forms such as cooperatives, association, etc, should fully understand their responsibilities for their works and against the government. These responsibilities can be summarized as follows:

- accepting the management of the irrigation and drainage network
- exchanging the agreement between government and farmers' group including:
  - o Using technical staff for operation and maintenance of the network

- o Developing the suitable organization chart to manage the system
- o Preparing the staff work plan
- o Staff training
- o Supervising the staff
- o Budget planning and estimating costs and incomes
- o Evaluating technical and financial performances
- o Conducting safety procedures and guarding irrigation infrastructures
- o Cooperation with the governmental supervision institutes
- o Providing necessary data and information to the supervision institutes
- o Complying with the rule and guidelines according to the contract

ROLES OF BANKS AND FINANCIAL INSTITUTES

Banks and financial institutes have an important role in this procedure. They usually provide most of the necessary funds for project construction or rehabilitation. Since farmers are not able to invest all the money for the project and there are a group of farmers who benefit from the project, it is difficult to find a single solution for the problem of giving loan to the farmers for this type of projects. Almost 10 years experiences of the Agricultural Bank in this subject show that the following actions are necessary to be taken by financial institutes:

- Guidelines for contract between governmental agencies and financial institutes
- Reviewing the proposed plans and project considering financial and technical aspects
- Developing easy procedures for giving loans to the selected projects
- Control and monitoring the disbursement of the funds
- Regulation on civil partnership and loan repayment procedure

CONCLUDING REMARKS

With external assistance and internal commitment, the water sector has made great progress over the last decade in Iran. However, there are doubts over the institutional capacity and overwhelmingly public administration at present, to meet this change. Transferring the management of the irrigation to farmers will have many advantages in saving the water and better operation and maintenance of the irrigation systems. It is necessary that the government takes the primary steps in this reform. On the other hand, as farmers get empowered they clearly occupy some political space as seen in other countries with similar conditions. Therefore, it is necessary to prepare a clear policy and guidelines to implement the farmers' rights and prevent conflict between different stakeholders.

REFERENCES

1- Briscoe, J. 1999. The financing of hydropower, irrigation and water supply infrastructure in developing countries, *Water Resources Development*, 15(4), 459-491.

2- Contreras, N. 2000. *Efficient management of water resources: An analysis of grey literature for the new millennium*. Third World Centre for Water Management, Mexico, 320p.

3- Coward, E.W and G. Levine. 1987. Studies of Farmer-Managed Irrigation Systems: Ten Years of Cumulative Knowledge and Changing Research Priorities. In Public Interventions in Farmer-Managed Irrigation Systems. Digana Village via Kandy, Sri Lanka: IIMI, pp. 1-31.

4- Easter, W., 1998. Irrigation Improvement Strategy Review: A Review of Bankwide Experience based on Selected 'New Style' Projects. Washington, D.C.: The World Bank, pp. 1-25.

5- Economic Commission for Latin America and the Caribbean 1995. *Private participation in the provision of water services. Alternative means for private participation in the provision of water service*, vol. 1: Economic Commission for Latin America and the Caribbean.

6- Economic Commission for Latin America and the Caribbean 1998. *Report of the second workshop on private participation in water supply and sanitation utilities in the Americas.* Economic Commission for Latin America and the Caribbean, San Jose, Costa Rica, Consultanse February 3-6.

7- Franceys, R. 1997. Private sector participation in the water and sanitation sector, UK Department for International Development Occasional Paper No. 3, DfID, London, UK.

8- Peter J.R. 2003. Capacity building for PIM – The case of Andhra Pradesh. FAO/ICID International Workshop on capacity Building for Irrigation and Drainage, Montpellier, France.

9- Repetto, R. 1986. Skimming the water: Rent-seeking and the performance of public irrigation systems. Research Report No. 4. Washington, DC: World Resources Institute.

10- Rosegrant, M. and H. Binswanger. 1994. Markets in trade-able water rights: Potential for efficiency gains in developing country. Water Resource Allocation. World Development Vol.22 (11): 1613-1625.

11- Turral, H. 1995. Devolution of management in public irrigation systems - cost-shedding, empowerment and performance - a review. ODI Working Paper 80.

12- World Bank. 2003. Electronic Learning Guidebook for Participatory Irrigation Management, World Bank Institute, Available online: http://www.worldbank.org/wbi/pimelg/

BROADENING THE FRAMEWORK OF PARTICIPATORY IRRIGATION MANAGEMENT: FROM EFFICIENCY TO SUSTAINABILITY AND EQUITY

K. J. Joy[1]

1. INTRODUCTION

Though Participatory Irrigation Management (PIM) – both in terms of policy support and practice on the ground – gained currency in India in the 90s, the early articulations about user participation in irrigation management can be traced way back to the 1930s. The Irrigation Enquiry Committee headed by Sir Vishvesaraya in 1938, which went into the causes of under utilisation of irrigation water in Maharashtra, a central-western state in India, did recommend, amongst other things, the formation of users' groups to improve the utilisation of impounded water (Lele and Patil 1994)[2]. In terms of official talk and policy support, the Sixth Five Year Plan (1980-85), the Guidelines issued in 1985 by the Command Area Development Programme under the Ministry of Water Resources, Government of India, the National Water Policy of 1987, and the Irrigation Pricing Committee (1992) headed by A. Vaidyanathan all talk about the need for farmer participation in irrigation management as a way out for the crisis in the irrigation sector in India. Non Governmental Organisations (NGOs) took the lead in setting up pilot projects, especially in the states of Maharashtra and Gujarat, in the late 80s and early 90s. PIM in India got further fillip when the Planning Commission of India set up a Working Group on PIM for the Ninth Five Year Plan (1995–2000). As of today, PIM has gained roots in many states in India and about six to seven states have already enacted legislations that make PIM a statutory requirement to get access to irrigation water and many of the other states are also contemplating enactment of similar legislations.

Thus, it would not be wrong to say that there has been a definitive change in the situation in respect of the Participatory Irrigation Management (PIM) in India since the late eighties. In the late eighties there were very few Water Users Associations (WUAs) in any form whatsoever and the Irrigation Departments (IDs) of the various states were extremely sceptical, if not hostile, to the concept of PIM. Much of the discussion in

---

1- Senior Fellow, Society for Promoting participative Ecosystem Management (SOPPECOM), 16 Kale Park, Someshwarwadi Road, Pashan, Pune 411008, Maharashtra, India. Tel. No.: 91-20-25880786; Fax: 91 20 25886542. Email: joykjjoy@gmail.com, soppecom@vsnl.com

2- In fact the earliest water users' associations or societies were formed as early as the 1930s on the Godavari canals, Maharashtra, by the local private sugar factory. The Samvatsar society is an example of this. Another example of the early efforts at user participation in Maharashtra is the Malinagar Irrigators' Water Supply Co-operative Society, registered in 1967, on Neera Canal meetings and conferences on PIM was focused on arguing for or against PIM. While the sceptics are still around, their number is diminishing and the question of whether or not there is a need for PIM seems to have been largely answered in the affirmative.

This paper is based on two assumptions. One, PIM in India is desirable, is no more on trial and it is here to stay. Two, PIM if it has to become an instrument of water sector restructuring, then it has to go beyond the present limited objective of efficiency and make sustainability and equity as its normative concerns and design the PIM accordingly. To argue that it is possible to go beyond the present preoccupation with efficiency and re-design PIM to encompass normative concerns of sustainability and equity, the paper analyses two cases of PIM initiatives from Maharashtra, namely, the Ozar WUAs in Nashik district and the Tembu Lift Irrigation Scheme in South Maharashtra. It is hoped that the lessons learned from these two grassroots experiences would help in expanding the present framework of PIM in India.

2. NEED TO GO BEYOND THE LIMITED FRAMEWORK

PIM is one form of collective action, which is seen by and large as a "joint management" or "co-management" strategy to manage irrigation water. Though the two terms contain certain differences, both essentially mean state initiated partnerships in which the rules of the game are decided by the irrigation agency and the local WUAs have very little say in these (Lele 2004). This is the case with most of the legislations in India regarding PIM and only in Maharashtra there has been some attempts at defining water entitlements or provisions for volumetric supply and pricing and for compensation if the users do not get their entitlements (GOM 2005[a] and 2005[b]), which can be empowering for the WUAs.

The experience so far indicates that the impact of PIM in India has been, by and large, limited to efficiency objective like increase in area irrigated, increase in irrigation intensity, improvement in the maintenance of the system and improvement in collection of water charges (Lele 2002)[1]. The main reason for this is that PIM has been designed only to address issues related to efficiency, the assumption being that the water sector crisis in India is primarily one of lack of efficiency.[2] As Mollinga puts it, the move towards PIM is largely driven by three 'crises' (Mollinga, 2000): a financial crisis (IDs not being able to recover water charges and hence not being financially viable), a technical crisis (irrigation systems are in disrepair) and crisis of legitimacy (as faith in the irrigation system's ability to deliver has eroded). Except the third crisis (that of legitimacy) the first two are clearly related to efficiency. Of course there is also the push from donor agencies (World bank for example) to push for reforms including PIM. Since PIM has been pre-occupied with only efficiency one could say that the space and potential opened up through PIM for water sector restructuring has not been fully exploited or explored.

Apart from the faulty analysis of the water sector crisis another important reason for the limited framework underpinning PIM efforts in India is that the wider developmental objectives of sustainability and equity have not become part of the normative concerns of PIM. Understanding the crisis and the changes that are taking place in the water

1- For a recent review of PIM in India see Lele 2004.

2- For a detailed discussion on the water sector crisis see Paranjape and Joy 2004.

sector requires first an understanding of the notion of 'development' as what is desirable and how this broad notion is to be translated into the specific context of water. The notion of development or the normative framework underpinning PIM today is limited to only efficiency. "Appropriateness" of institutions and design of institutions depend upon one's normative concerns (Lele 2002). In other words the motivations driving PIM today in India is limited to a framework limited to efficiency considerations (SOPPECOM 2004).

Also there are two viewpoints at work here. The mainstream viewpoint sees PIM mainly as a *transfer* of the irrigation command from the hands of the ID to the hands of the farmers, treats this transfer as the main objective and the benefits then flow from that transfer. The non-mainstream viewpoint does acknowledge this transfer, but treats that transfer as a *means* or *instrument* of restructuring the water sector improving its performance, ensuring equitable water access and allowing a transition to a sustainable and integrated management and use of water resources (SOPPECOM 2004). There is a need to shift from the transfer viewpoint to a restructuring viewpoint by incorporating the broad developmental objectives of efficiency, sustainability and equity[1] part of the normative framework of PIM.

Though one may not be able to go into a detailed discussion on sustainability and equity[2] here the debate can be summarised in terms of certain minimum principles as given below:

SUSTAINABILITY

- Sustain the underlying bio-physical processes, their environmental integrity and dependability as mediated by human intervention
- Conserve and/or enhance the primary productive and assimilative potential of the ecosystem
- Use water within renewable limits: use annual flows, stocks to be used only in bad years with the understanding that they would be replenished in good years. Minimise import of water, do it in a fair manner

EQUITY

- Ensure inter-sectoral equity: water use prioritisation
- Ensure minimum water service livelihood needs to all on affordable terms irrespective of landholding

1- *Efficiency* is concern with maximizing current well-being derived from the natural world at minimum cost, whether measured in physical or monetary. *Sustainability* is concern about the continuation of well-being into the future and within this, concern for ecological sustainability is based on the idea that there is some "immutable biophysical basis to human well-being". *Equity* is concern about the *intra-generational distribution* of human well-being, across typical barriers of class, ethnicity, gender, etc., including concerns about fairness of outcome as well as process. It is relevant both in the context of sharing of the fruits of resource use and also in the context of externalities generated by resource extraction, processing and consumption (Lele 2002).

2- For a detailed discussion see Joy *et al* 2004 and Joy *et al* 2005

- Favour those bearing the brunt of the inequity due to class, caste, ethnicity, gender, spatial location, etc.
- Sharing of shortages
- Provide women with preferential access to water both for domestic and productive uses

The two case studies, given below, show that it is possible to go beyond the limited framework of efficiency and also address issues related to sustainability and equity.

3. THE OZAR WATER USERS' ASSOCIATIONS: PIM AN INSTRUMENT OF CO-MANANGEMENT OF SURFACE AND GROUNDWATER[1]

THE LOCATION AND SALIENT FEATURES OF THE PROJECT

The Ozar WUAs, namely, the Banganga Water Distribution Co-operative Society, the Mahatma Phule Water Distribution Co-operative Society and the Jay Yogeshwar Water Distribution Co-operative Society were formed in 1991 in Ozar village, 16 kms north of Nashik town and about 150 kms away from Mumbai in Nashik district of Maharashtra. The Ozar WUAs lie in the extreme tail portion of the Right Bank Canal (RBC) of the Waghad dam command area.

The Waghad dam, built across the Kolwan River, is one of the four dams (the other three being Ozarkhed, Karanjwan and Palkhed) that comprise the Upper Godavari Project. The Upper Godavari Project has been planned to service an irrigable command area (ICA) of about 59,000 ha spread over 180 villages in six talukas[2] of three districts in Maharashtra. The ICA of Waghad system comes to 6,750 ha. Waghad is an eight-monthly irrigation project in the sense that water is not provided for hot weather crops.

Table 1: Salient features of the Upper Godavari Project (comprising Waghad, Ozarkhed, Karanjwan and Palkhed dams)

	Upper Godavari Project	Waghad system
Gross Storage	341.14 Million m^3	76.5 Million m^3
Live Storage	317.68 Million m^3	70 Million m^3
Gross Command Area (GCA)	104,100 ha	13,500 ha
Culturable Command Area (CCA)	89,400 ha	9,640 ha
Irrigable Command Area (ICA)	59,000 ha	6,750 ha

(Source: Samaj Parivarthan Kendra, 1994, p. 1)

1- This section is largely based on a study by Paranjape and Joy, 2004
2- Tehsil is a sub-district administrative unit

The operational area of the three Ozar WUAs comprises a contiguous geographical area of about 1,300 ha with gross and culturable command areas as shown below in Table 2. The details of water quota[1] allocated to the three WUAs are given in Table 3. The ID allowed the WUAs to carry over the unused water from the Rabi quota to summer (hot weather) taking into account the evaporations losses.

Table 2. Gross and Culturable Command Areas of the Ozar WUAs

	Banganga	Mahatma Phule	Jay Yogeshwar
Minor	Distributary 1 of Sub-Minor 3	Minors 17 & 18	Minors 18A &19
Gross Command Area (GCA)	249 ha	432 ha	615 ha
Culturable Command Area (CCA)	216 ha	340 ha	595 ha

(Source: Samaj Parivarthan Kendra, 1994, p. 9)

Table 3. Irrigation quotas of the Ozar WUAs[2]

WUA	CCA	Kharif (Monsoon crop) quota ('000 m^3)	Rabi (winter crop) quota ('000 m^3)
Banganga	216	424	528
Mahatma Phule	340	440	1,016
Jay Yogeshwar	595	1,216	1,410

(Source: Samaj Parivarthan Kendra, 1994, p. 10)

The major initiative in setting up the Ozar WUAs was taken by the *Samaj Parivartan Kendra* (SPK) a social organisation in the area. Society for Promoting Participative Ecosystem Management (SOPPECOM)[3] provided the necessary technical assistance to SPK.

1- Maharashtra is the only state where the Memorandum of Understanding signed between the Irrigation Department and WUA provides for water quota to each WUA proportionate to its area. It is also the only state which provides for volumetric supply and pricing of irrigation water.
2- Note that the ad-hoc allocation gave Mahatma Phule a relatively smaller kharif quota and a relatively higher rabi quota. The quotas for all the societies have subsequently been reduced by 12%.
3- SOPPECOM was formed around 1990 with the specific objective of promoting participative management and sustainable and equitable use of natural resources, especially water and had taken the initiative in setting up the first pilot projects in PIM in Maharashtra. For details of SOPPECOM's activities, especially in the PIM area visit www.soppecom.org

SOME OF THE INNOVATIONS

The Ozar WUAs have performed very well by any of the conventional norms like membership in the WUA, irrigation efficiency, increase in the ICA, maintenance of the system, managing the water properly, and collection of water charges. Besides being good WUAs, they have also struck out in new directions and set significant precedents in PIM. Interestingly the Ozar WUAs are more known for these innovations that can provide valuable lessons for water sector restructuring in India. For lack of space only two innovations – co-management of surface and groundwater and volumetric supply and pricing of water to the users – are taken up for a brief discussion below.

1) Co-management of surface water and groundwater: One of the most important innovations of Ozar WUAs pertains to the co-management of surface (canal water and groundwater (water from wells). First, SPK convinced the Government to build 18 check dams on the streams within the command area of the three WUAs as a special case as this is not allowed in Maharashtra. The check dams played a dual role: one it helped to harvest the rainfall and two they also helped in collecting the "losses" from the distribution system through seepage. WUAs also put a part of their water quota into these storages. Because of these local storages the recharge increased and almost all the wells in the command area became perennial. Second, they switched to a system of one rotation from the canal and the next rotation from the wells. This not only provided stability to the system through improved dependability but also gave them the flexibility to go for crops like vegetables and fruits like grapes which require light but high frequency irrigation. It also improved water use efficiency and also crop productivity as the farmers could provide water as per crop requirements. Third started charging the well owners water charges. This is a very significant step because well water is generally seen as a private property in India and though there is a provision to charge well owners in the command area the provisions are seldom used by the ID. In the case of Ozar WUAs, SPK could clearly show to the members that the increase in the wells is because of the efforts of the WUAs as they had kept a detailed record of each of the wells in the command area showing what was the situation before WUA formation and after. SPK also devised simple but robust and transparent method of estimating the recharge of each well and each well owner was charged accordingly. The charge they levied for the well water was half of the charges of the canal water. Thus the WUAs could extend their jurisdiction over the wells in the command too and become an instrument of integration of local and exogenous water and surface and groundwater.
2) Volumetric supply and pricing - switching to hourly basis: In Maharashtra under PIM WUAs pays the government on the basis of the metered quantity of water it receives, but the internal distribution of water and assessment of water charge for users remain based on area and crop. It decreases state presence, facilitates recovery of water charges and links them to volumetric supply, but for the *individual* farmer in the command, nothing much changes, and his/her costs are still not linked to the volume of water he/she uses. In creating a push in the direction of water saving and increasing efficiency of water use, it goes only half the way. However, volumetric supply to individual farmers is said more easily than done. The need is to find a solution that is readily acceptable to farmers and easily implementable with little or no transaction cost. The Ozar WUAs evolved such a solution, first implemented in full in Mahatma Phule and Jay Yogeshwar WUAs in 1998-99 and also applied in

Banganga WUA around 2002-03. Estimating the losses and delays and leaving a small cushion for adjustments, they calculated the total time that would be available for watering. Dividing this time by the total demand for irrigation, gave a figure of the time taken to irrigate one ha. At present this estimate, in farmers' terms, is that of watering 1 *bigha* in one hour. A *bigha* is roughly half an acre, so that the norm here is that of 5 hours/ha. The water charge was then converted to the number of hours a farmer received water. The calculation was simple enough to understand and, though there were some doubts, the farmers agreed to give it a try. The system has now been in operation for four years in two of the societies. The issues have not been fully settled but there has definitely been an overall acceptance.

The switchover to an hourly basis for assessment of water charge has led to an increase in discipline and efficiency. The canal operators had received instructions that they should supply water for the calculated time and the farmer should be ready to receive water. Farmers began to try and prepare their fields well in time and manage their affairs in such a way that they would be ready to irrigate their fields when it was their turn to receive water. Earlier the canal operator would generally have to wait till the farmer was satisfied that he/she had `filled' his/her farm. He could try and persuade but not stop the farmer from taking more water than was customary, and only if it was excessively wasteful could he take the matter to the WUA. Now the whole problem was simplified at one stroke. All the canal operator had to do was to see that he got so many hours of flow, and it became the responsibility of the farmer to see that his field was irrigated within that time. The result was a greater awareness on part of the farmers and an increase in water application efficiency.

Seeing the success of the Ozar WUAs, the farmers from the entire command area of Waghad project have formed WUAs. The WUAs have been federated into a federal society and recently the entire project has been turned over to the federal society. This is the first case of project level transfer in India.

4. THE TEMBU LIFT IRRIGATION SCHEME: PIM AS AN INSTRUMENT OF EQUITY AND CO-MANANGEMENT OF ENERGY AND WATER[1]

THE LOCATION AND THE PROJECT

The Tembu Lift Irrigation Scheme (TLIS) in Satara, Sangli and Solapur districts of South Maharashtra is one of the many government operated high lifts coming up in the Krishna basin to divert water to the drought prone regions of the basin as part of a wider plan to utilise Maharashtra state's share of the Krishna waters.[2] There is a sharp variation in the availability of water amongst the different sub-basins within the Krishna

1- This section is drawn from Joy and Paranjape

2- The Krishna Water Distribution Tribunal, which went into the question of sharing the Krishna waters amongst the riparian states of Maharashtra, Karnataka and Andhra Pradesh Maharashtra, Karnataka and Andhra Pradesh apart from deciding on the relative share of each of the state also stipulated in its Award, known as the Bachhawat Award, that the states should utilise their share of water awarded to them by June 2000, failing which the unutilised share would be pooled together and would be open for negotiations and re-distribution. Since none of the states could actually utilise their share of water the Government of India has constituted a tribunal to go into the question of the sharing of the unutilised water.

basin. At the bottom of the heap is the Yerala sub-basin with an estimated per capita water availability of 83 m^3 (year 2001) and at the top we have the West-South sub-basin of Upper Krishna with a corresponding per capita availability of above 4,900 m^3, almost 60 *times*! The administrative sanction for the project was given in 1996 and presently the works on the high lifts and the main canal have reached an advanced stage.

As per the project design the scheme would lift water to about 300 meters in five stages and would utilise 22 TMC of water to irrigate about 79,600 ha area in 173 villages in six tehsils in the eastern part of the basin through an extensive network of canals as per the details given in Table 4 below.

Table 4. Details of irrigation area and water use according to different tehsils

Tehsils	No. of villa-ges	Total area (ha)	Culturable command area (ha)	Irrigated command area (ha)	Irrigation intensity (%)	Water use	
						TMC	Mm^3
Karad	2	1,150	860	600	69.77	0.16	4.70
Khanapur	86	61,350	49,100	28,300	57.63	7.82	221.63
Tasgaon	15	20,570	15,450	7,700	49.84	2.13	60.30
Atpadi	36	61,568	43,100	16,000	37.12	4.42	125.3
K.Mahankal	13	13,750	10,300	7,000	67.96	1.94	54.82
Sangola	21	36,500	29,200	20,000	68.49	5.53	156.63
Total	173	194,888	148,010	79,600	53.78	22.00	623.38

(Source: Maharashtra Krishna Valley Development Corporation Documents, cited in Joy and Paranjape, 2004)

STRUGGLES TO RESTRUCTURE THE SCHEME IN EQUITABLE LINES

As seen in Table 4 above, each tehsil is allocated a particular water quota from the scheme and within the tehsil the water would be distributed on the basis of designed cropping pattern and area basis (as per gravity flow). Those who have lands in the designated command would get water, those who have more land would get more water and those who do not have land in the command area would not get access to water with the result that some of the villages would be fully irrigated, some would be partially irrigated and the others would not get any access to water. Though the primary objective of the scheme is drought proofing the scheme in its present design would not eradicate drought of vast majority of the population in the area.

The local people under the leadership of Shetmajoor Kashtakari Shetkari Sanghattana (Organisation of Agricultural Labourers and Toiling Peasants, SKSS to be brief) agitated against this demanding restructuring of the scheme on equitable lines. Their contention was that if water is being brought to the drought prone region involving huge investments both in terms of money and energy (the per ha cost as per the original cost estimate is about USD 4,000 (and this would go up by the time the project gets completed), total Horse Power (HP) required is about 200,000 and the electricity required is about171 MW) then the water should be equitably distributed so that it can eradicate everybody's drought in the area.

Along with agitations SKSS also explored various options, with support from SOPPECOM, to make the scheme viable both economically and in terms of energy as some of the critics projects had written off the scheme as an unviable one and would only serve to eat into the finances of the state (Godbole 2002). The alternative proposition from SKSS included the following:

- Take up local water harvesting through micro watershed development programmes along with the implementation of TLIS (basically integration of local and exogenous water) and use water from water from a larger source like Krishna to stabilise the local water systems
- Distribute water equitably to all the households in the region and SKSS showed that it is possible to distribute about 5000 m^3 of water (at source) to each of the household in the region as basic service to meet livelihood needs and the surplus water can be distributed to those who want more water for commercial crops as economic service
- Form WUAs at the village level and the ID should provide water to these WUAs on a volumetric basis and the WUAs in tern would distribute the water equitably to all those who reside in the village including those who do not have land[1]
- Provide basic service (5000 m^3 of water) to all the households at an affordable cost basically to cover operation and maintenance cost (and because of the electricity use the O & M costs would be substantially higher than the typical canal irrigation water) and the economic service to be provided at a much higher rate to even recover capital costs over a period of time. This is some sort of a graded tariff system that the Irrigation Pricing Committee had advocated (Government of India 1992)
- Bring a portion of the land in the command area under energy plantation to partially meet the energy requirements of the scheme

COMMITMENT TO EQUITY AND CITIZENSHIP AS THE CRITERION FOR MEMBERSHIP IN THE WUAS

As a result of the agitations and negotiations by SKSS the government agreed to restructure the scheme in three tehsils (Atpadi, Tasgaon and Sangola) as a pilot project. As per the agreement water would be allocated to each village on the basis of population but within the quota allocated to each tehsil as per the original plan. The villages can form WUAs taking village as a unit (and not the designed command) and the WUAs are free to distribute the water on an equitable basis to the villagers irrespective of landholding. All families in the village can become members of the WUA. Thus there is a shift in the criteria of membership – shift from possession of land in the command area to citizenship in the village. This has significant implications for widening the scope of PIM, especially in terms of both equity and membership. It is also important in the context of the growing criticism that co-management institutions

1- Those who do not have land can take land from others on a produce sharing arrangement (like WUAs) are leading to “participatory exclusions” and they have been also arguing that citizenship should be the criteria for membership of these institutions and not one’s status as a user or present access to the resource (Agarwal 2001).

FROM WUAS TO WEUAS

Another important learning is that energy is a price that has to be paid for equity, as certain amount of lifting energy would be required if everybody has to get access to water. Thus energy and water co-management is an important precondition for this. One of the other important implications of the need for energy and water co-management is to move from Water Users Associations (WUAs) to Water and Energy Users Associations (WEUAs). It is essential that there should be a unified management of water and energy. By changing over from the command area as basis to village or region as basis will facilitate this changeover. Just as the WUAs receive water at a given point on a volumetric basis from the ID the WEUAs can receive energy and water at selected points on a metered basis and may then decide on how to distribute this cost internally. Since equitable access implies household rather than command area as the basis, and consequently, habitat, village and similar units at higher levels it is easier for them to make the transition from WUAs to WEUAs.

Though the scheme is not operational yet, it is important that SKSS could bring the government to the negotiating table and make it agree to principles and norms, which can make PIM an instrument of inclusion and equity. SKSS has already started the process of forming the WUAs on the explicit understanding of equity and the experience it would generate would be valuable to expand the present limited framework of PIM to include equity as an important normative concern.

5. CONCLUSION

The foregoing discussion shows that PIM has taken roots in India both in terms of policy support and practice. However, the gains of PIM have been limited to efficiency considerations and it is rather difficult to address water sector crisis in India within this limited framework of PIM. Instead it is important to expand this framework to include concerns of sustainability and equity if PIM has to become an instrument of restructuring the water sector in more sustainable and equitable lines. The two case studies discussed also show that it is possible to incorporate efficiency, sustainability and equity as overarching concerns of PIM. For this it is important to shift from the “turn over” viewpoint to “restructuring” viewpoint.

Though it would not be possible to detail out the strategy for this shift within the limits of this paper[1] it definitely calls for both enabling policy support and also an incentive system. PIM legislation should include positive enabling provisions, or at least it should not foreclose options, that may become acceptable in the near future. For example, provisions that take `what is’ as given and absolute and include them as part of the legislation may function as foreclosing options that may be better, more equitable and more sustainable. In fact this is happening in most of the states in India where PIM legislation has taken place as the rules and regulations of these legislations serve to

1- This is discussed in greater detail in SOPPECOM 2004 consolidate the interests of those who are already in a favourable situation in terms of possessing land in the commands. They do not provide for progressive negotiations with regard to acquiring new water rights or access to water. Instead, legislations should be flexible enough to include provisions that offer space offer innovative experiments like the Ozar WUAs or the restructuring TLIS. Also there should be willingness to learn from such experiments and efforts should be made mainstream the principles these experiments embody.

There is also a need to actively encourage those PIM groups who do take up issues of sustainability and equity in a pro-active manner. There should be some kind of incentives built into the PIM structure that rewards those who do so. The problem of incentives is simpler to handle in the bottom-up strategy[1] that does not rely on legislation. In fact, in Maharashtra, the simple expedient of a policy in which WUAs received water with higher priority than non-WUA areas has acted as good incentive towards PIM in many cases. In general, in a motivational strategy it is easier to structure incentives. Things change as soon as we come to the legislative, top-down strategy. Since by statute all areas are now WUA areas (that being the point of the legislation), it is difficult to build in incentives. Nevertheless, it may be suggested that WUAs who show good performance and take successfully pro-active steps towards ensuring equitable access, increased efficiency and sustainability should be conferred some relative advantage in water allocation and/or water rates. The social benefit of such measures often far exceeds the small relative advantage that may have to be conferred on such action.

REFERENCES

1. Agarwal, B, 2001, “Participatory exclusions, community forestry, and gender: An analysis for South Asia and a conceptual framework”, World Development 29(10): 1623-1648.
2. Godbole Madhav, 2002, `Withering Away of Canons of Financial Propriety: Maharashtra’s Finances’, Economic and Political Weekly, January 12, 2002.
3. Government of India, 1992, *Report of the Committee on Pricing of Irrigation Water under the Chairmanship of Dr. A. Vaidyanathan*, (mimeo), New Delhi.
4. Government of Maharashtra, 2005[a], Maharashtra Water Resources Regulatory Authority (MWRRA) Act, 2005 (Maharashtra Act No. XVIII of 2005), Mumbai
5. Government of Maharashtra, 2005[a,] Maharashtra Management of Irrigation Systems by Farmers (MMISF) Act, 2005 (Maharashtra Act No. XXIII of 2005), Mumbai.
6. Joy, K. J., S. Paranjape, A. K. Kiran Kumar, R. Lélé and R. Adagale, 2004, "Watershed Development Review: Issues and Prospects", CISED Technical

1- In India there are two strategies for promotion of PIM. One is the legislative root, which is also called the big bang approach or top down approach, and Andhra Pradesh was the first state to adopt such a strategy. In contrast there is the motivational approach, which is also called the bottom up approach, as in the case of Gujarat and also Maharashtra till the recent legislation in which the ID and the NGOs motivate the farmers along with certain incentives to go for PIM.

Report, Centre for Interdisciplinary Studies in Environment and Development, Bangalore.

7. Joy, K. J., A. Shah, S. Paranjape, S. Badiger and S. Lele, 2005.
8. Lele, S., 2002, "Beyond state-community polarisations and bogus "joint"ness: Crafting institutional solutions for resource management", in Proceedings of the 50th Anniversary Conference on "Globalisation and Poverty", ISS, Hague.
9. Lele, S. N., and Patil, R. K., 1994, Farmer Participation in Irrigation Management: A Case Study of Maharashtra, New Delhi: Horizon India Books.
10. Mollinga, P. P., 2000, "The inevitability of reform: Towards alternative approaches for canal irrigation development in India", in L. K. Joshi and R. Hooja (Eds.), Participatory
11. Irrigation Management: Paradigm for the 21st Century, vol. 1, Rawat Publications,
12. Jaipur.
13. Paranjape, Suhas and K. J. Joy, 2004, Water: Sustainable and Efficient Use, Centre for Environment Education, Ahmedabad.
14. Samaj Parivartan Kendra
15. SOPPECOM, 2004, "Participatory Irrigation Management: An overview of issues and the way ahead", paper presented at "National Workshop on Participatory Irrigation Management and Volumetric Measurement" organized by Water and Land Management Institute, Aurangabad and Society for Promoting Participative Ecosystem Management, Pune at Aurangabad, Maharashtra, during 2-3 July.

ESTABLISHING WATER USER ASSOCIATIONS FOR O&M IN BILEHSAVAR-MOGHAN IRRIGATION SYSTEM

Mohammad Ebrahim Najafi[1]

ABSTRACT

Bilehsavar-Moghan sprinkler irrigation system is located in Bileh-Savar and its villages' proximity with a net area of 3100 hectares. The main irrigation system contains one 3 m^3/s central pump station and 3 convenience concrete canals 21km length and minor irrigation system has 21 secondary pump stations along open channels to supply water for 21 irrigation units with an average area of 150 hectares. Field irrigation system is solid set sprinkler irrigation system.

The whole area is divided into 1394 fields and 713 owners with the average of each field 2.2 hectares. Most of small fields do not have regular shape e.g. some of them are very long with 50m width and 1.5km length. Accordingly, operating a modern irrigation system is very complicated. Therefore, 21 water user associations (WUAs) and 2 rural co-operative companies established by incorporation of water users.

The main purpose of co-operatives and W.U.A. is to teach farmers and group them for O&M modern sprinkler irrigation system and its accessories. In this article, 4-year experiences and conclusions will be covered.

INTRODUCTION

Non-governmental organizations (NGOs) play an important role in realizing public desires and goals; and reflect the society's concealed requirements to the government. Generally they are the link between the body politic and government. Efficient and democratic governments pay much attention to people's expectations and ideas so they respect non-governmental organizations and associations. They also make great effort to improve quality and quantity of these associations.

Some of participatory user association researchers believe that the aim of users participatory is to associate them in different project stages such as programming, constructions prioritizing, and scheduled O&M of constructed accessories by using all financial, mental and physical facilities. Bilehsavar sprinkler irrigation system is the applied and objective example of this theory.

1- B. A. in Agricultural Economics and Saman-Abrah Consulting Eng.'s manager of Operating and Maintaining Dept. Tel: 0912-5277133, Fax: 021-88693074, Email: nina1359@yahoo.com.

1. HISTORY OF BILEHSAVAR PROJECT

Moghan irrigation system main canal with the length of 113 km, supplies water for approximately 90000 hectares of the field. Most of the lands are supplied by gravitational surface irrigation system, but some of them use inline pump stations to be supplied. The last pump station is the 8^{th} pump station with a discharge of $3m^3/s$ which is located 12 kilo meters far away from Bilehsavar and the foresaid pump station is established by financial participation of water users and Water Organization of Ardebil province. Figure 1 shows Bilehsavar project location in Ardebil province.

Lands in project boundary are dry farming and have very low yield because gravitational supply from the main canal is not possible and sprinkler irrigation system will cover these lands in the future. After construction of the main pump station, Jahad Keshavarzi organization of Ardebil province commenced the study of irrigation system project and after preliminary study, assigned the final design of irrigation system and establishment of W.U.A. to Saman-Abrah consulting Eng.

While constructing project components, the consultant stated the cultural, social and training of water users permanently and has established 21 WUAs for 21 irrigation units in 2 rural co-operative companies.

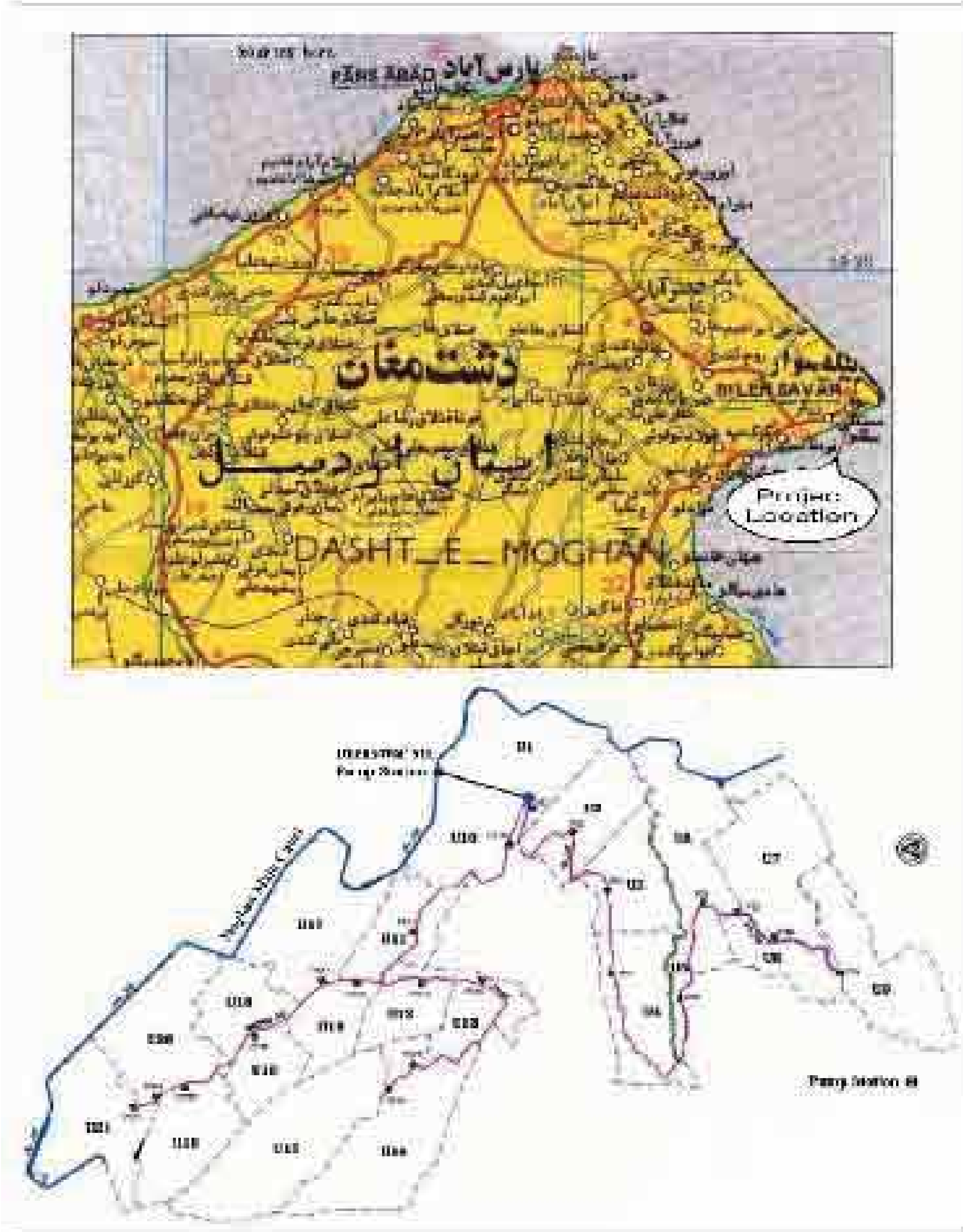


Figure 1. Project location in Bilehsavar (Ardebil province)

2. METHODOLOGY OF ASSOCIATIONS ESTABLISHMENT

To achieve the expected goals, the following topics were evaluated by consultant studying workgroups:

- Present condition study of agriculture and animal husbandry;
- Environmental investigations;
- Land ownership studies;
- Basic studies for associations establishment;
- Collecting users' information and ideas (general and especial questionnaires);

- Social and cultural issues investigations;
- Water using system study; because of its importance, experts and specialists founded a programming committee in the consultant central office and all social issues decisions have been firstly approved by this committee, then operated by resident experts in the field.

General investigated topics to establish associations for O&M are as follows:

- Water using systems analysis in Iran
- Results analysis of some other countries experiences in O&M associations of irrigation systems
- Holding personal interviews with farmers, paying attention to farmers' viewpoints and anxieties.
- Consulting with clients and certain experts.

3. OPERATING SYSTEM PLAN AND ESTABLISHMENT OF 21 ASSOCIATIONS

About establishing W.U.A., at first, land usage systems before reforming land rules in Iran and after the Islamic revolution, were analyzed. Then, land usage system background in Bilehsavar was studied.

Participation concepts and viewpoints in agriculture development in Iran and effective positive/negative elements in water users' participation were analyzed. Also the past condition of W.U.A. in Iran and applied experiences of establishing associations in irrigation systems were discussed.

Other countries experiences in user participation were studied to achieve wider range of information. Therefore, several reports from Turkey, India, Mexico, Spain and Colombia were studied. Also personal explores in irrigation associations in Nile delta in Egypt, pressure irrigation systems operation methods in Italy, and water distributing method in borders of Gharehghoom canal in Turkmenistan were useful to find the solutions.

Using above experiences, the consultant could attain worthwhile results by cultural, social and economical studies and providing 4990 general and family questionnaires for all water users. Therefore, the consultant could obtain a comprehensive knowledge about human resources, population and available potentials of land use management in different decades and prevalent cultivations in the area. Also cooperation level of water users with active agriculture organizations and W.U.A. was determined. Fig. 2 and 3 show questionnaires answering by water users.

Figure 2, 3: Bilehsavar water users answering questionnaires in the consultant office (right) and at home (left).

Analysis's results show that 713 water users own 1394 field lots with the average area of 2.2 hectares. Field lots and water users are increasing because of dividing due to inheritance and land sales rule. Available statistics confirm that 24% of fields have less than 1 hectare area, and 90% of them are smaller than 5 hectares. Water user family members are 4159 persons which are 74% literate and 36% of them have academic and high school studies. Figure 4 illustrates field blocks before the project implementation.

Figure 4. Field blocks before the project implementation

3.1. IRRIGATION UNIT ADMINISTRATOR ELECTION

After basic analysis and social-cultural studies, because the project area was divided into 21 separate 26-260 hectares irrigation units, one separate pump station was determined for each irrigation unit to supply enough head pressure of irrigation system. In order to assign O&M responsibility to water users, a W.U.A. was established for each irrigation unit. Candidates' introduction sessions were held and water users voted and elected 3 reliable persons as O&M administrators for 2 years. Therefore, there were 63 persons elected as O&M administrators for irrigation system and its accessories, after establishment of 21 associations. Figure 5 shows 21 irrigation units mapped by the 8th pump station Central Committee, and Figure 6 illustrates O&M associations' organization chart in each irrigation unit, and figures 7 to 10 show O&M administrator election sessions for different pump stations.

Figure 5. 21 irrigation units after Bilehsavar project designing

3.2. ELECTED ADMINISTRATORS (3 PERSONS) RESPONSIBILITIES IN ASSOCIATIONS

The responsibilities are as follows:

The first person: as the main representative and pump station administrator

The second person: as the deputy and responsible for solving discords (judgment)

The third person: irrigation officer

The above persons attended applied training courses and received introduction to systems and operating methods user manuals due to their responsibilities in 2 years.

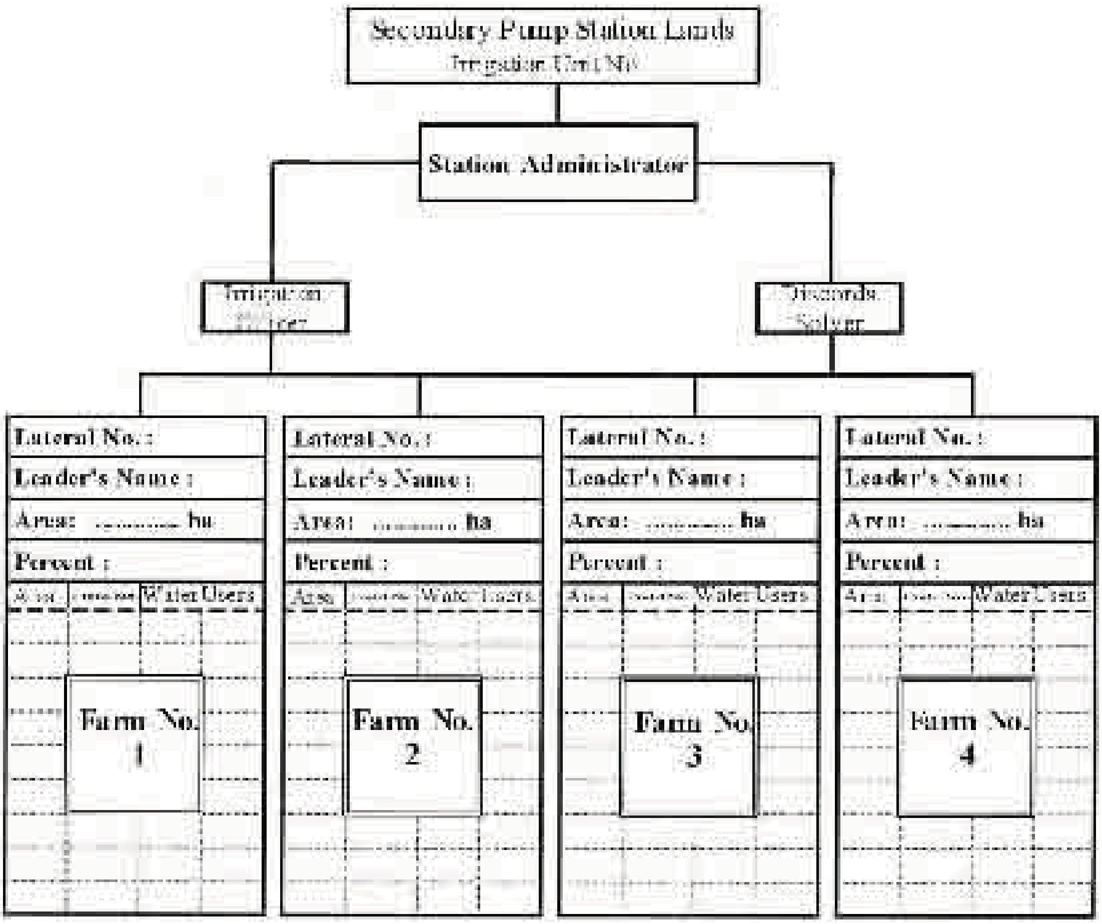


Figure 6. W.U.A organization chart in each irrigation unit-Bilehsavar-Moghan project

Figures 7, 8. Water users remarkable attendance, in the 7th pump station coordinating session.

Figures 9, 10. 11th pump station O&M administrators' election and coordinating session.

People elected totally 63 administrators (3 for each irrigation unit) and their responsibility interpretation is as the following:

1. Attending training sessions and courses which are held by the consultant or client (task master).
2. Being fully coordinated by director manager and board of directors of co-operative companies and system operation administrators.
3. Pursuing water users' commitments and payments for water and confirmed annul O&M costs.
4. Continual and periodic supervision of irrigation systems and secondary pump station to pursue the problems to be solved by technical system administrators.
5. Supervising on water users' irrigation.
6. Observing irrigation schedule based on cultivation pattern, and in time water distribution among users.
7. Solving water users' discords which are related to water distribution and irrigation.
8. Supervising on pump station and the accessories protection and security in O&M periods.
9. Co-operation with consultant experts to advance project goals.
10. Conducting water users to farm accretion.

4. RURAL CO-OPERATIVE COMPANIES FOUNDATION IN PROJECT AREA

The importance of establishing operation associations to use loans and legal subsidies (related to fundamental activities), were explained in workshops and training sessions for water users. In these workshops, different methods of using available potentials in the project area were described. Water users preferred the co-operative operating system in comparison to other methods, due to the following specifications:

Preserving each user's land ownership, conceivable overall cultivation, possible common water use, conceivable programming for mechanization and decision making based on co-operative company's rules. Bilehsavar Jahad Keshavrzi organization and Ardebil province Jahad Keshavarzi organization attempted to establish the general assembly and selected board of directors among irrigation units no.1 to 9 (with the area of 1200 hectares) water users and finally, Sagheh-Talaa rural co-operative company founded and started since 2003, managed by one of local agriculture experts. Figure 11 illustrates main pump station, secondary pump stations, and 1 to 9 irrigation units organization chart in Sagheh-Talaa rural co-operative company.

Also Ghatreh-Baran rural co-operative established in irrigation units no.10 to 21 (1900 hectares approximately) in 2004. Figure 5 shows the irrigation units in each rural co-operative.

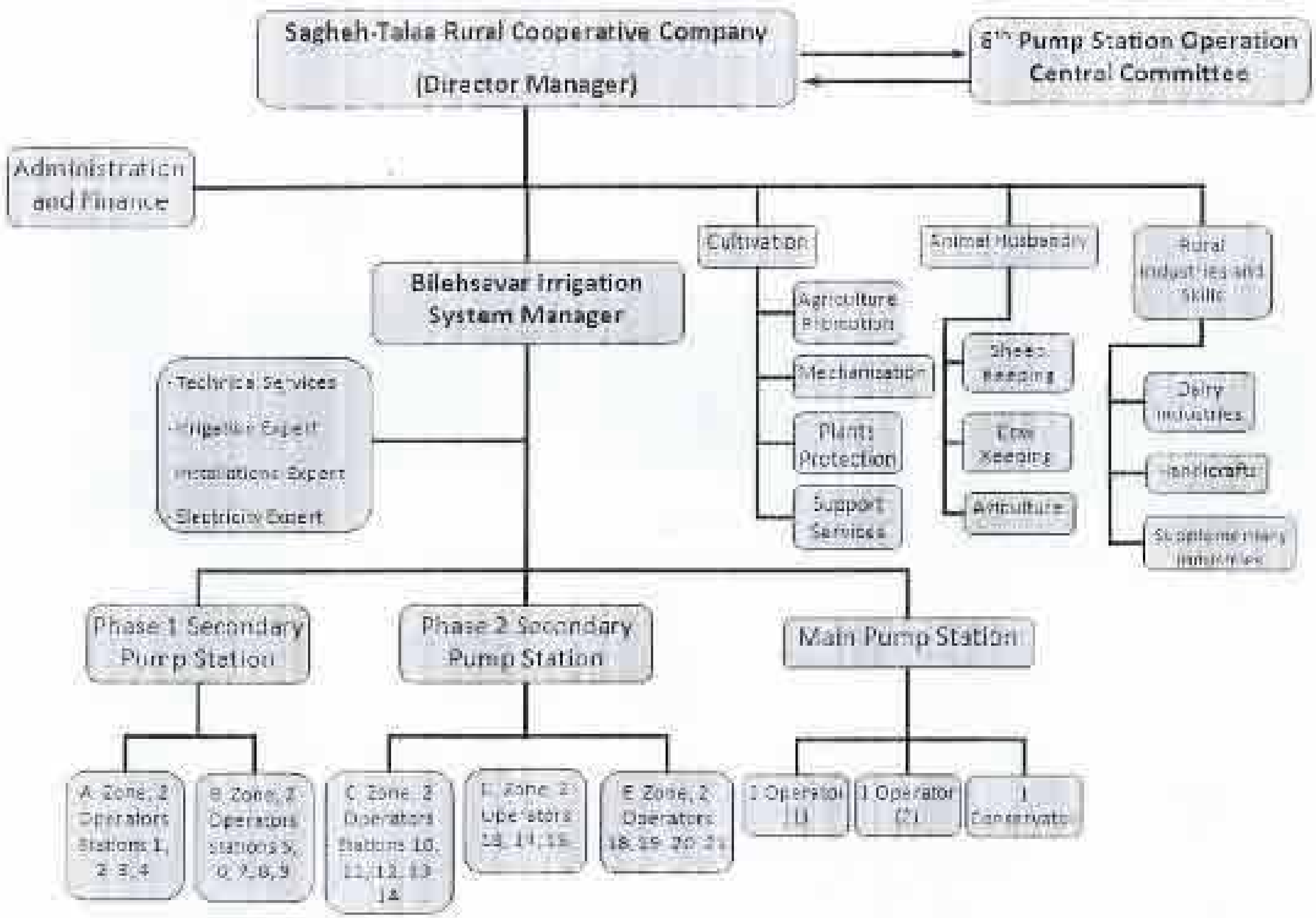
5. CULTURAL AND DIDACTIC ACTIVITIES

Since establishing O&M water user associations, performing training programs and providing and delivery of simple instruction manuals for operators, irrigators, administrators and all project beneficiaries, were the most important job that the consultant have done in corporation with local administrators.

which the bigger part of it is accomplished and will be in progress simultaneous with project operation. The following instruction manuals and training catalogues are mostly provided and/or are being provided:

- Introduction to solid set sprinkle irrigation system in Bilehsavar
- Solid set sprinkle irrigation system O&M instruction manual
- Secondary pump stations instruction manual for operators
- Electrical installations instruction manual in secondary pump stations
- Irrigated farming in operating period instruction manual
- Main pump station (8th Bilehsavar pump station) instruction manual
- Providing irrigation system O&M methods and Bilehsavar project movies and delivering the video CDs and video tapes among water users.

Figure 11. Main pump station, secondary pump stations and 1 to 9 irrigation units operating management organization chart



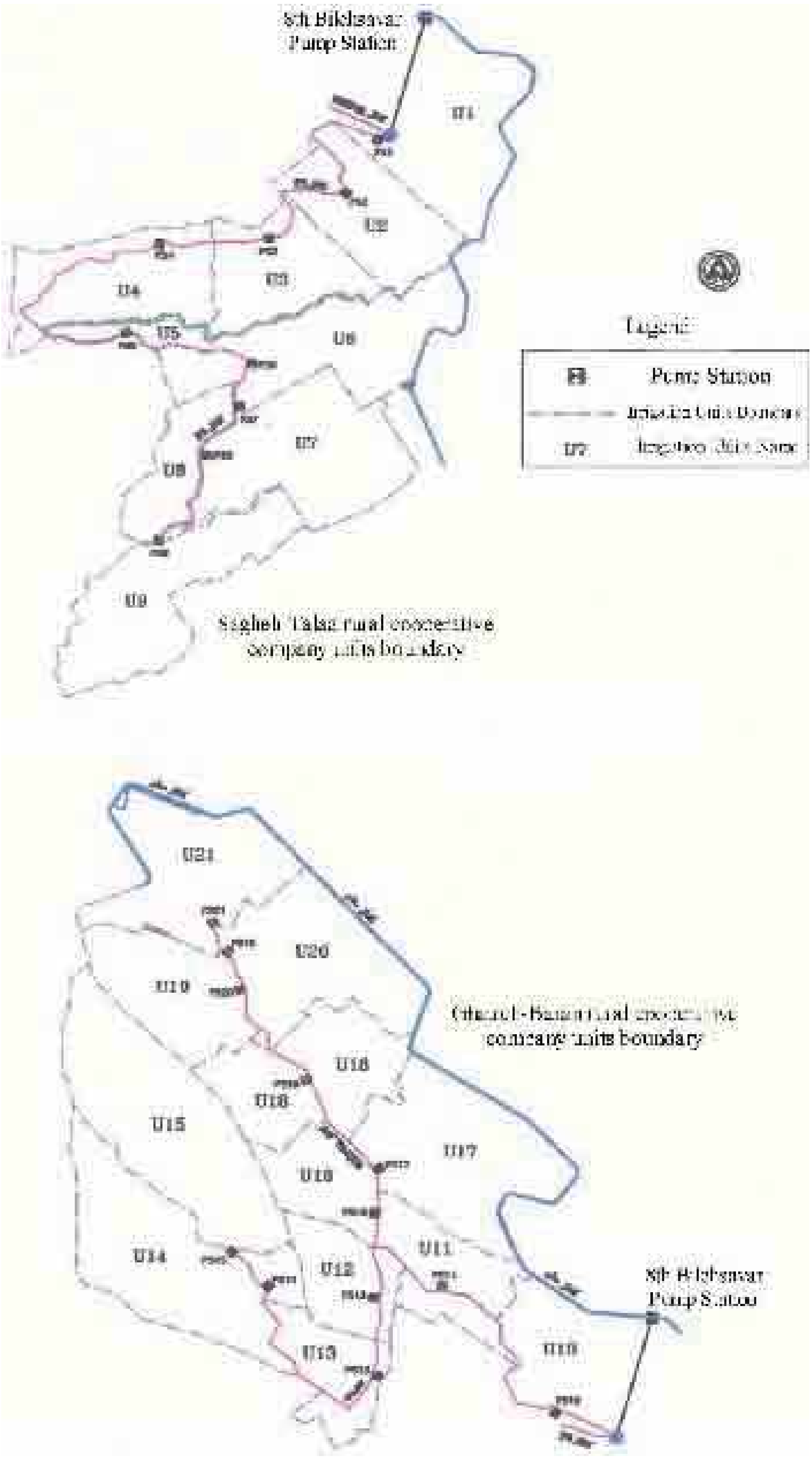


Figure 11. (1 to 9) and (10 to 21) irrigation units in Bilehsavar-Moghan

5.1. TRAININGS

Training water users is one of the headmost activities of consultant in this project which is to be continued till the end. Social, agricultural, and technical experts are used to teach sprinkler irrigation system to water users, administrators and water users' representatives so they can protect valves, pipes and other accessories while using them. Figures 13, 14 show Bilehsavar water users training sessions in Jahad Keshavarzi management amphitheater in the town.


Figures 13, 14. Bilehsavar water users training sessions.

5.2. ESTABLISHING PROGRAMMING AND OPERATING COMMITTEES

The consultant established the following programming committees in order to assimilate ideas and cultural/social activities, and getting better results from local operators and administrators' ideas:

- Consultant central office programming committee; consist of social science professors and irrigation systems operating experts.
- Ardebil province programming committee; consist of provincial experts and consultant representatives.
- Bilehsavar operation committee; consist of all project administrators in the town, water users representatives, and consultant representatives.
- Project opponents' resolver committee; consist of co-operative companies, executor, and consultant representatives.

It is important to mention that W.U.A. representatives, cooperate well to resolve opponents problems and ownership boundary mistakes during the construction duration. They have cultivated soybean and cereals in constructed parts of the project, using their trainings, skills and experiences.

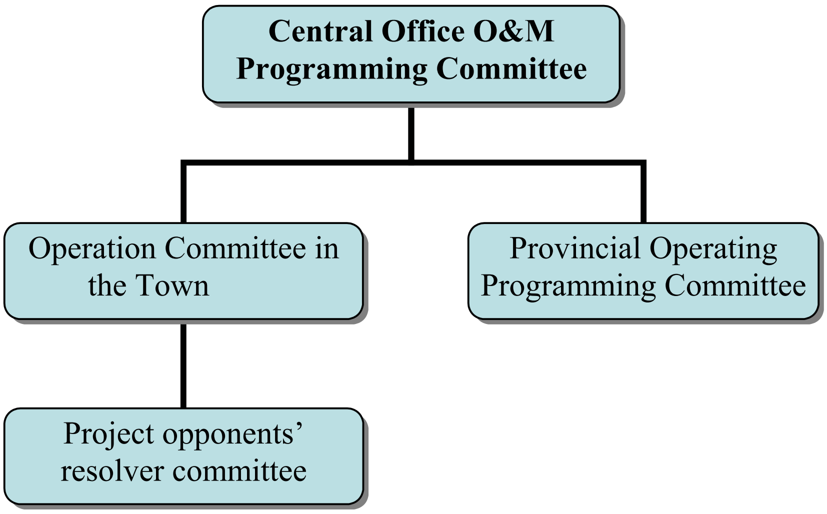


Figure 15. Programming and operating committees organization chart

6. INCORPORATING FARMS IN 21 IRRIGATION UNITS

Existing numerous small field blocks number in each irrigation unit, is one of Bilehsavar project problems which has overshadowed operation system compilation due to sprinkler irrigation system implements in the project area and the consultant has schematized to solve this problem.

As it is shown in Table 1, each irrigation unit (21 units), has the minimum area of 26 hectares to 260 hectares maximum. This kind of classification is based on topography, distance, sprinkler irrigation system head pressure requirements and head losses calculations. Each irrigation unit consists of 24 to 126 small irregular shape fields and 21 to 87 water users.

Each irrigation unit has secondary pump station in order to supply the necessary head pressure for sprinklers, based on designing. Main pipelines, sub main lines and laterals, supply water in irrigation wings. There are minimum 2 and 19 maximum laterals in each irrigation unit, depending on coverage area. Laterals' coverage area is the basis of incorporated farms in irrigation units and every farm which consists of several fields with different owner is an incorporated unit.

Each lateral's lairds are the components of an incorporated farm. Water users of each farm elect a leader in every tillage period and all O&M problems are supposed to be solved through the leader.

Table 1. Bilehsavar 8th pump station irrigation units' specifications.

Net Area (ha)	**Supply Canal**	**Irrigation Unit Name**	
174.6	P8	U1	
149.2	P8	U2	
119.9	P8	U3	
149.0	P8	U4	
26.1	P8	U5	
164.3	P8	U6-1	U6
30.1	P8	U6-2	
179.1	P8	U7	
95.9	P8	U8	
183.7	P8	U9	
137.1	P8A	U10	
97.7	P8A	U11	
84.9	P8A	U12	
83.6	P8A	U13	
24.4	P8A	U14-1	U14
214.5	P8A	U14-2	
260.0	P8A	U15	
77.1	MIRP8A	U16	
195.9	MIRP8A	U17	
171.1	MIRP8A	U18	
128.2	MIRP8A	U19	
185.1	MIRP8A	U20	
169.5	MIRP8A	U21	
3100.9	Total		

The number of laterals in each irrigation unit is shown in Table 2 which are incorporated farms in that irrigation unit. As it is shown in this table, all project laterals (or incorporated farms) are totally 178 farms with average area of 17.5 hectares.

Table 2. Number of laterals in each irrigation unit

No. of laterals (incorporated fields)	Irrigation Unit Name	No. of laterals (incorporated fields)	Irrigation Unit Name
6	12	14	1
4	13	12	2
11	14	7	3
19	15	10	4
2	16	2	5
11	17	16	6
6	18	11	7
6	19	4	8
6	20	11	9
5	21	11	10
178	Total	4	11

Figure 16 shows field blocks before (a) and after (b) project implementation.

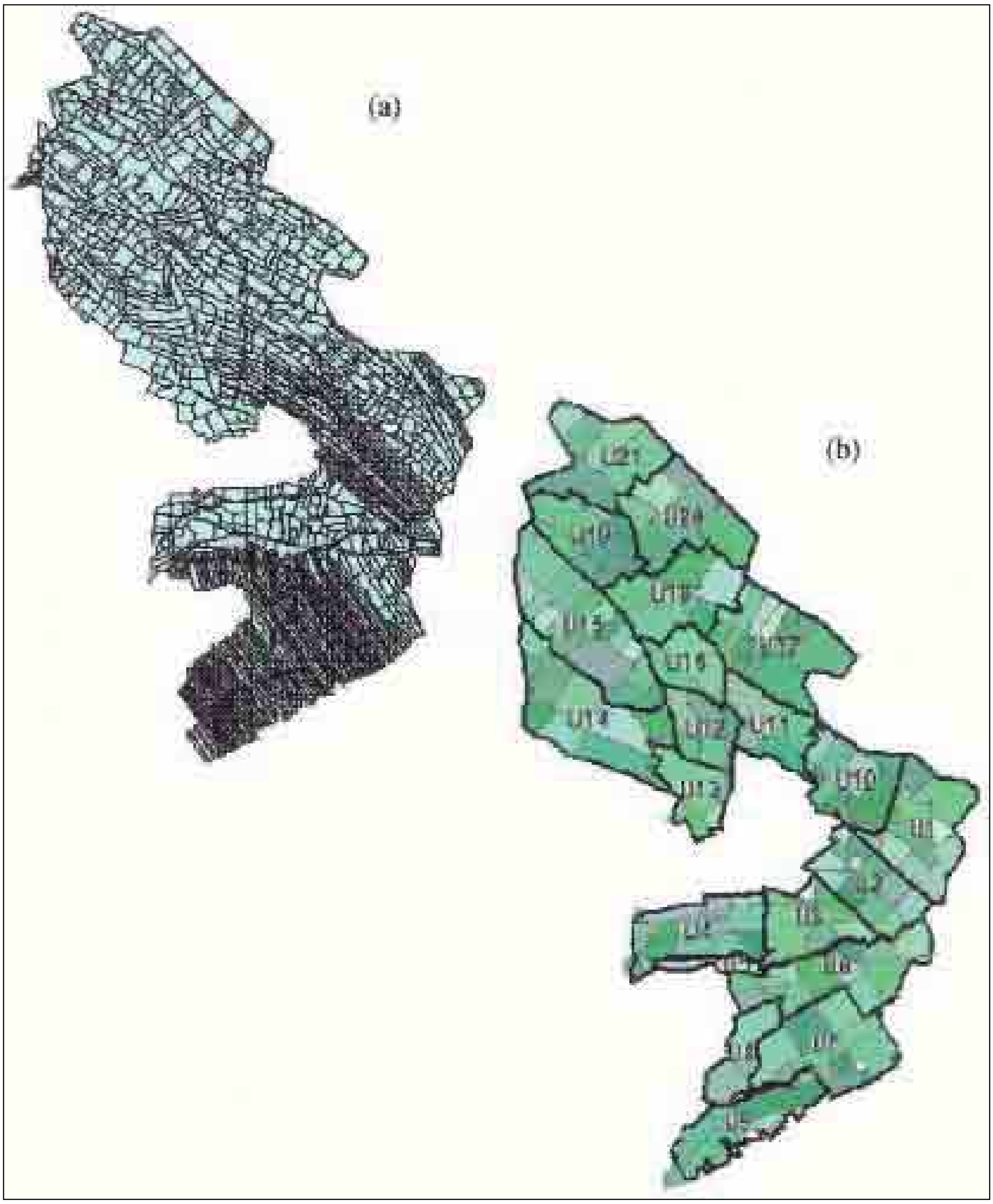


Figure 16. Field blocks before (a) and after (b) project implementation.

7. ASSOCIATION ESTABLISHING THEIR RESOLVING UNITS

Tribal oppositions were of most important problems through water users associating in addition to the following difficulties, which the consultant challenged to establish W.U.A. and cooperative companies. Most of the problems solved by consultant's experts' continual attendance in social activities, frequent personal negotiations with farmers, holding coordination sessions with local trust worthies, holding workshops with local administrators and water users' participation, and technical and economical project justification. The most important knots in irrigation associations are as below:

- Farmers' high resistance against any kind of association and cooperatives during the first days.
- Bad memories of agricultural-joint stock companies in farmers' minds due to some managers malfunction in Babak and Bilehsavar area, before Islamic revolution.
- Farmers' financial participation before social studies without awareness of project's operation system.
- Farmers' owing to Agriculture Bank, not knowing about irrigation system and that independent use of water in each irrigation unit with the average area of 2.2 hectares with pressure irrigation system is impossible; and it should be designed for corporation water usage.
- Land owners have often several jobs and are not totally dependent to theirs land's income.

8. SOLUTIONS TO IMPROVE AND STABILIZE ESTABLISHED ASSOCIATIONS

Water users would be indifferent and associations would easily disintegrate, if there is not public trainings and taskmasters' financial supports; and their problem should be solved by administrators. Therefore, after any association establishment or cooperative company foundation, they must be supported normative, financially and spiritually by respective administrators and managers in order to become fully stable.

Here are the most important advices to improve and stabilize associations in irrigation systems fundamental projects:

- Projects financial support codification, to solve the technical problems and possible errors quickly, at least 2 years after handing over the project to farmers.
- Taskmaster and consultant's representatives' attendance in project, at least 2 years after handing over the project to user association.
- Holding extra training sessions and field workshops, associations technical, financial and administration guidance.
- Holding weekly/monthly coordination sessions with associations' administrators and local trustees and evaluating farmers' performance in operation periods.
- Providing financial workbook of water users financial participations and clarifying charges in order to present the report to users and administrators.
- Making legal discounts of water price for farmers who have financially participated in the main pump station, convenience networks and laterals construction; and who established W.U.A. to participate in irrigation management.

- Codification and performing users' capability improvement to promote their payment ability in O&M periods of projects.
- Codifying and approving operation management organization chart with the participation of local experts.

9. CONCLUSION

Establishing O&M associations has the following most important results:

- Water users' taking part in project programming and politicizing, because of their investment participatory on Bilehsavar 8th pump station, convenience canals and irrigation system construction.
- All Bilehsavar farmers' utilization from water supplies and dry lands promotion to irrigated fields.
- Strategic crops (wheat, cotton, soybean, alfalfa) cultivation development in project area.
- Agriculture occupation opportunity development and productive job increscent.
- Social and technical promotions among people in project area.
- Providing cumulative cultivation in solid set sprinkler irrigation system and improving 1394 irregular scattered fields to 178 incorporated regular farms.
- Social problems (due to 713 water users in 1394 units) reduction.
- Mechanization standards promotion utilizing existing facilities.

REFERENCES

1. 2003, Bilehsavar-Moghan 8th pump station sprinkle irrigation system revision technical report, Saman Abrah consulting Eng., vol. 9.
2. 2004, Bilehsavar sprinkle irrigation system O&M studies report, Saman Abrah consulting Eng., vol. 1,2,3.
3. 2006, Bilehsavar sprinkle irrigation system water users participatory and financial analysis of O&M report, Saman Abrah consulting Eng.

PARTICIPATORY MANAGEMENT AND USERS ASSOCIATIONS CASE STUDY: DOOSTI DAM AT THE BORDER OF IRAN-TURKEMINISTAN

Dr. Fatemeh Vosooghi[1]

ABSTRACT

Water plans are included among fundamental plans that result in social and economical development. These types of plans make the essential role of the government very crucial in terms of budget supply and the management of such plans. On the other hand, the limitation in governmental budgets and management calls for the participation of people in water plans. Because of the magnitude of these plans, a more supportive force than governmental budgeting and management is required.

Article No. 107 of the fourth development plan law of the Islamic Republic of Iran permits government to involve the non-governmental sector (landlords and water right-possessors) in the water plans and make water and soil utilization organization to implement economizing policies and direct farming water users to improved utilization. In the direction of the fulfillment of this policy, the formation of public organizations at dam drains to deliver water and participate in the construction of irrigation network of agricultural lands at the downstream of the dams is necessary.

From the legal point of view, communal irrigation organization means the organization of farmers that have the water embranchment (subscription) under the same farming water resource. Utilization organizations, also, include utilization companies, communal irrigation organizations or public groups who cooperate in the process of water utilization management.

This condition had to be materialized in the case of the shared dam of DoosTI (Friendship) between Iran and Turkmenistan.

The method of the formation of communal organizations has been considered in this study.

1- Managing director, Amayesh consulting Co., Executive manager and adviser to the regional water company of Khorassan in social study for the Dam of Doosti in Serakhas, No. 92, Sadjad Boulevard, Between Bahar and Khayyam. Mashad – Iran Amayesh consulting Company.
7640040 Fax: 0511-7621658 E.mail: info@amayeshco.com

INTRODUCTION

In Islam religion with a particular economic system, the mutual co-operation and participatory system is much emphasized. After the Islamic revolution in Iran people participation in economy and social justice became principle of the country's objectives. Since 1980, all countries of the world including developed industrial countries with capitalism and socialism ideology and also the developing countries in the third world, realized that without people participation and association, development could not be reached. Therefore, the science today has completely accepted the people participation in development.

Understanding the world concept of people participatory principles, I.R. Iran, applied the policy of participation, by reducing the government share in economic and business, assigning the people affairs to people to decrease and solve the existing social and environmental problems. The parliament approved laws followed by the governmental regulations for optimum use of water and fair water distribution, to be enforced by the Ministry of energy (water resource deputy) and the Ministry of Jihad Keshavarzi (Agricultural Ministry) to provide facilities for transferring the water management to associations and also provide facilities for the formation of water users associations. These provisions would facilitate the execution of the participatory objectives of the government. According to our country laws and international experiences, participatory management in historical – traditional level has been a necessity for our country development.

1- According to Iran History and tradition references in tens of books and hundreds of specialized articles, there has been no programmed accomplishment completed unless the people participatory management had guaranteed the projects (Popoliyazdi, 1381– Safinejad, 1368 –Farhadi, 1373 and others).

2- Formation of NGOs are legally accepted in the world and most of the countries constitution, support the NGOs.

3- City and villages councils are supported in chapter 7 of I.R. of Iran constitution, particularly in articles 100 and 104. In the 4th Iran Development Plan the participation of people is recommended in accordance to article 5, 17,10, 50, 52,71, etc.

4- The best way to transfer management to people, is to form people associations, That is why in many parts of the world governmental regulations and parliament's laws support the formation of associations and cooperatives.

5- In I.R. of Iran constitution, the cooperative is mentioned as the third principle of Iran economy. In article 107 of the third Iran Development Plan, re-approved in article 4 of the 4th development plan, the participatory irrigation management and the formation of Water Users Associations is recommended too.

MAIN QUESTION:

FORMATION OF PEOPLE'S ASSOCIATIONS[1] AT THE DOWNSTREAM OF DOSTI DAM IN SERAKHAS.

The republic of Turkmenistan and the government of I.R.of Iran signed a contract to construct the Doosti Dam on the Harrirud-Tajan River to provide the drinking water for Mashad and Serakhs as well as agricultural water for irrigation. It is also planned to use The Dam for prevention of floods that may destroy the potential agricultural lands in Serakhs and deconstruct the buildings at the border.

The accumulated water behind the dam are divided for use by Iran and Turkmenistan mutually. The regional water company of Razavi Khorassan has made a contract with a consulting company to form Water Users Associations in the region so that the water management could be transferred to the farmers .The establishment of water users cooperatives (associations) is a proceeding that follows the programme of optimum usage of agricultural water approved by the government and parliament. The consulting company performed a complete study on social and economic situations of water users in the region as well as a complete study of the rural geography and irrigation system of the past and the present. The study was done by the consultant, showed that the form of cooperative systems is preferred by: farmers, experts and authorities of the region as the best form of association.

OBJECTIVES:

The main purpose of this article is a survey on the formation of water users cooperatives in the down stream of Doosi Dam in Serakhs and description of the main problems existed during the procedure of cooperative formation.

THE FORMATION OF THE WATER USERS COOPERATIVES (WUCS)

The optimum usage of agricultural water in the 4th Iran Development Plan, The law of fair water distribution and other regulations and manuals on water usage in I.R. Iran, recommends the transfer of water management to farmers. Therefore, the formation of water users associations (cooperatives, associations, etc.) at the down-stream of constructed dams is a policy of Regional Water Companies and agricultural organizations in Iran. Improvement of management structure and decentralization accompanied by increasing the role of people in economic development resulted in developing laws and governmental regulations for the transfer of water management to farmers. According to the third and 4th development plan of Iran, especially in article 107 of the third plan, the regional water company of Razavi has begun the transfer of water management to farmers .The consultant has finished the establishment of 6 water users cooperatives at the down-stream of Doosti Dam in Serakhs. The following is the description of procedures:

1- In any pjart of this paper the word: ASSOCIATION means any kind of legal group formation such as cooperatives, stocd holder Co., trade associations, etc.

THE GEOGRAPHICAL SURROUNDING STUDY:

The city of Serakhs as an important region of the down stream of the dam is located in the northeastern part of Iran. It is located 180 Km from Mashad. Tajan River is the boundary line between Iran, Afghanistan and Turkmenistan. This boundary dam is constructed at 75 Km from the south of Serakhs on the Tajan River.

There are 29 villages on the down stream of the Dam. These villages all are users of the Dam's water and most of them are located at the west side of the Harirud – Tajan river.

The population of the region under study was 65246 persons (in 2006). From this Population 30108 persons are living in the rural area and 35118 persons were the citizens of Serakhs city. 75% of population are shiites and 21% are sunnittes. Baluch people are sunnittes and Sistanies are shiites.

RECOGNITION OF THE WATER RIGHT USERS AND CALCULATION OF THE WATER RIGHT USE FROM THE DOOSTI DAM FOR EACH WATER USER

Before the formation of the water users cooperatives, the allocation of the Dam water should be calculated. We first calculated the water right use for each water user. Then we calculated the total water right for each cooperative. The cooperatives made a contract with the Regional Water Company to collect the yearly water fee from the members and pay it to the water companies. According to the agreement, 12.5% of collected fees will be returned to the WUCs. The following information shows the specification of the water users cooperatives and their rights of water from the dam:

The land area of water right users from the Dam:	15667 hectare
The total volume of water right per year:	50.7 m Cu.m.
The total number of water users:	3256 persons
The number of established WUCs in 2006:	6 cooperatives
The name of Periodic managing director of all WUCs:	Haj Mohamad Ghasemzadeh
The number of the streams:	4 main streams about 70 Km and 230 Km sub-streams.

THE TRADITIONAL STRUCTURE OF WATER MANAGEMENT IN THE DOWN STREAM OF DOOSTI DAM

The structure of traditional water management depends to the physical layout of the streams and traditional system of cultivation in the region. There was an old system of water management some years ago that distributed water, controlled the water usage, cleared and repaired the streams. Cheif water distributors (SAR-SALAR) used to find the point of stream that needed clearance or reconstruction. Some Mirab (water distributor) was under the control of a SAR-SALAR. Mirab allocated the share of repairing for any SALAR (chief of some farmers) who was representative of a SAHRA and Sahra was a group of villages. SALAR allocated the share of the work for any Dehghan (farmer) from a village.

The Water distributors called MIRAB, when they ordered the work of clearance or repairing the stream, no one had the right to disobey the order. Farmers were selected from SAHRA for repairing the stream or change the water way, sometimes walked tens of kilometers to reach the point of stream that should be repaired or water way be changed to the other sub-stream.

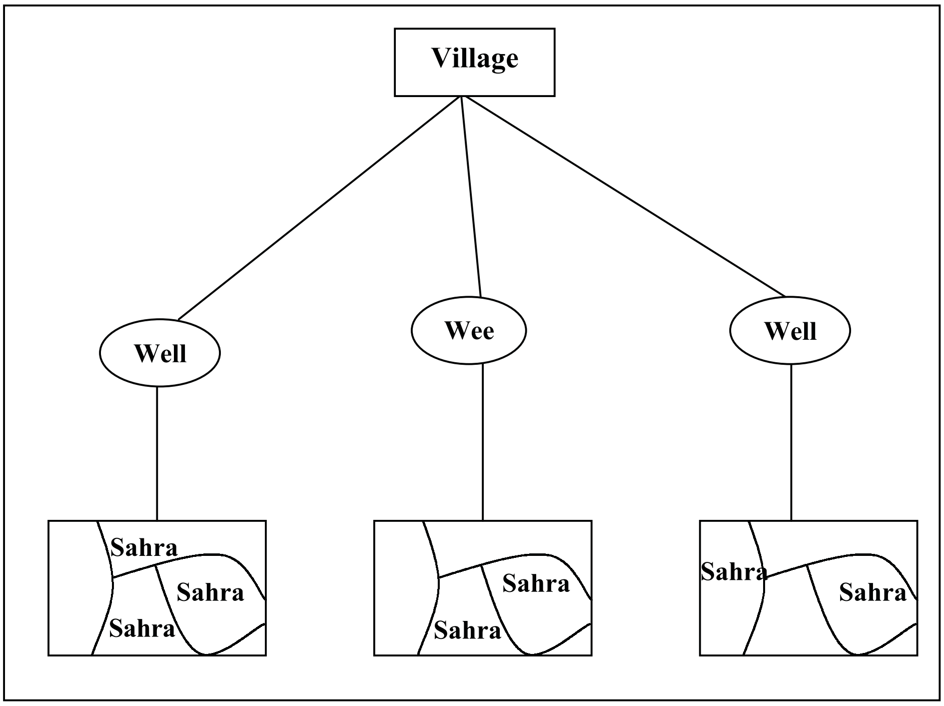
In 1981-1991 decade, Astan Ghods Razavi[1] constructed a long stream to get water from the dam for irrigation of Razavi land and at the same time started digging deep water well in the region. Astan Ghods, then, made contracts with farmers for utilization of agricultural water and land use.

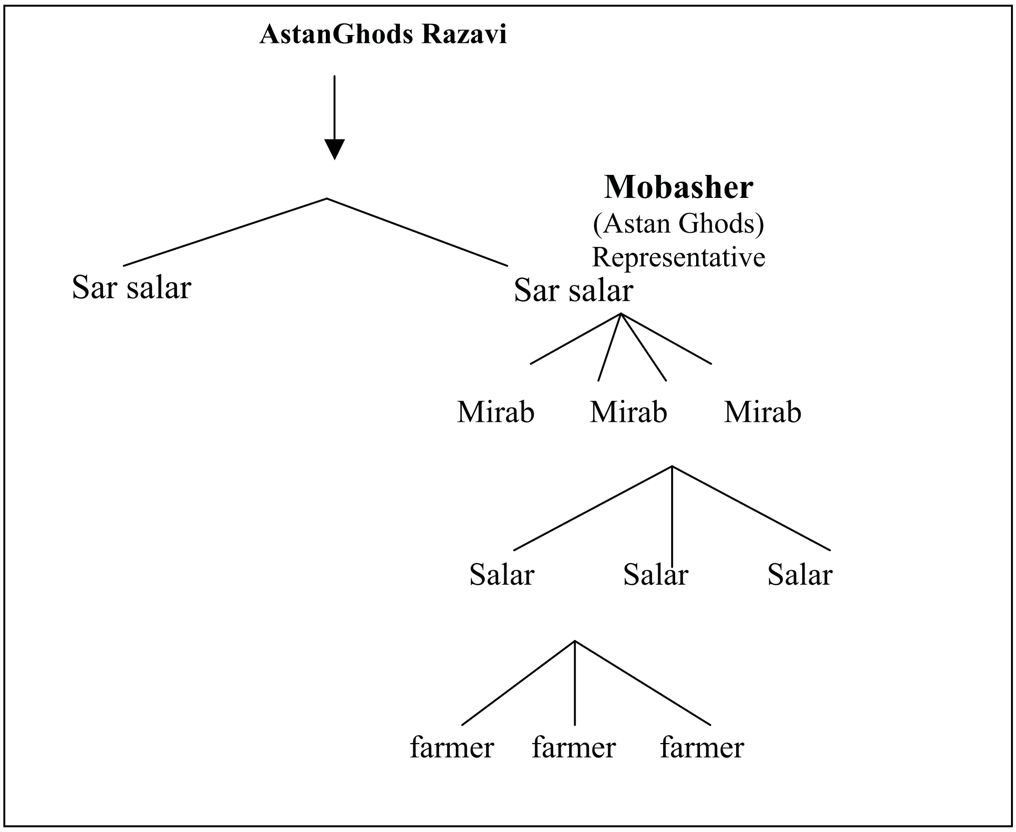
Before the revolution, according to the law of land reformation, some lands of Astan Ghods distributed among 1082 farmers in Serakhs region, each 6 hectare. The traditional management of water distribution deteriorated because of the change in ownership of the lands. Since then no other system has been substituted. Digging deep wells by Astan Ghods provided water to farmers and they did not need to use the stream water. Little by little the old tradition of water distribution was completely deteriorated.

The history of water in Serakhs comes to the point that all streams of water were deteriorated and MIRAB, the traditional water managers, were forgotten for many years. Due to the lack of management system and deterioration of river and stream water usage, and because of digging many deep wells by Astanghods or people, the pressure on the use of underground water exceeded and for the time being (2006), there is the problem of decreasing underground water for irrigation. In draught years there have been many conflicts among farmers for water usage that some-times have resulted in criminals and killing persons.

1- ASTAN GHODS RAZAVI: The management of lands and investments donated to the Shrine of Imam Reza in Mashad

Traditional management of water usage in down stream of Doosti Dam





The establishment of Water Users Cooperatives in The down stream of Doosi Dam – 2006

Following a survey in the region and listening to farmers, effective members of Islamic councils and the reliable persons in the villages, it is understood that they mostly prefer the cooperative system for the water management. So the consultant decided to establish some cooperative associations for water users in the region.

DETERMINATION FOR THE NUMBER OF WATER USERS COOPERATIVES WUCS.

The study shows that the process of association formation should be started from top a to the bottom. To organize the cooperatives, water should be chosen as a base, not the village. From the point of management the cooperatives should be neither too large nor very small. The physical shape of irrigation network is another factor in determination of cooperation area of a cooperative. Consulting with reliable persons and traditional water distributors, the consultant co., suggested the formation of cooperatives around the main irrigation streams. In the region there are 4 main streams starting from the south to the north or up-stream of Tajan River to down.

1- The Stream of Sangar

This is the first stream which bifurcates from Tajan River. Three villages were irrigated with this river called: Sangar, Kalateh Morehe (Haj Hossein) and Nowruzabad. The land was irrigated by this river was totally 682 Hectares and the Number of water users were 186 persons. A Water user cooperative formed around this stream, called Sangar WUCs.

2- Nowruzabad Stream

The second stream from Tajan River: This stream irrigates villages of Ghasemabad, Dowlatabad, Ghooshsarbozi, Ghaleh Ghassab, and some lands of Kachoolabad. The cooperative formed here is called Nowruz Cooperative.

3- The Revolution (or Dowlatabad) Stream

The third stream from Tajan River: This stream was constructed by Astan Ghods Razavi in 1983. It is suggested that a WUCs be formed around this stream.

Astan Ghods has constructed this stream to irrigate the agricultural land development in the area of Tapeh Sephid, The old airport and the lands under the project of pistachio planting.

4- The Mozafari Stream

This is the fourth and the last stream from the Tajan River. This stream is the oldest bifurcated one. The trunk also irrigates some villages. Water users are divided around the trunk and the two branches. So the consultant suggested 3 WUCs around the trunk and two branches.

4-1- a cooperative formed around the trunk called Etehad.

4-2- a cooperative called Etefeagh formed around the right branch which irrigates the Serakhs city and surrounding villages.

4-3- a cooperative called Yavaran. formed around the left branch. This cooperative includes the water users of seven villages.

Table (1) Villages shared in any WUCs and the name of the related streams

Item	Name of stream	Cooperative name	Villages
1	Mozaffari	Etehad	Asefabad,Ghalehno, Ghoshazim. Ghoshkohneh
2	Mozaffari	Etefagh	Ebrahimabad,Tommokhtar,Tapemirahmad, Serakhs, Abasabad
3	Mozaffari	Yavaran	Tomrasool,Ghoosh Khazaee Hasanabad,Ghoshalijan,Ghosh chaker,yaztapeh,kandali
4	Enghelab	Vahdat Tajan	Hasanabad, Dowlatabad,Ghoshkhzaee,Ghosh alijan,Kachooli
5	Nowruzabad	Nowruzabad	Dowlatabad,Ghalehghasab,Ghasemabad,Ghoshsarbozi, Kachooli
6	Sangar	Sangar	Kalatehmeraee,Nowruzabad,Sangar

Table (2) Name of Managing director of established WUCs and the registered No.

Stream name	Name of WUCs	Name of Managing Director	Registred No.
Mozafari	Etehad	Haj Shirmohamad Hosseinpoor	342
Mozafari	Etefagh	Haj Bratali Arab Khazaee	343
Mozafari	Yavaran	Haj Hosein Mishmast	
Enghelab	Nowruzabad	Hajmohamadali Rahsepar	344
Nowruzabad	Vahdat Tajan	Haj Eidmohamad Ghasemzadeh	348
Sangar	Sangar	Haj Alireza Abaszadeh	341

The limited area for the Water Users Cooperatives at the down stream of Doosti Dam

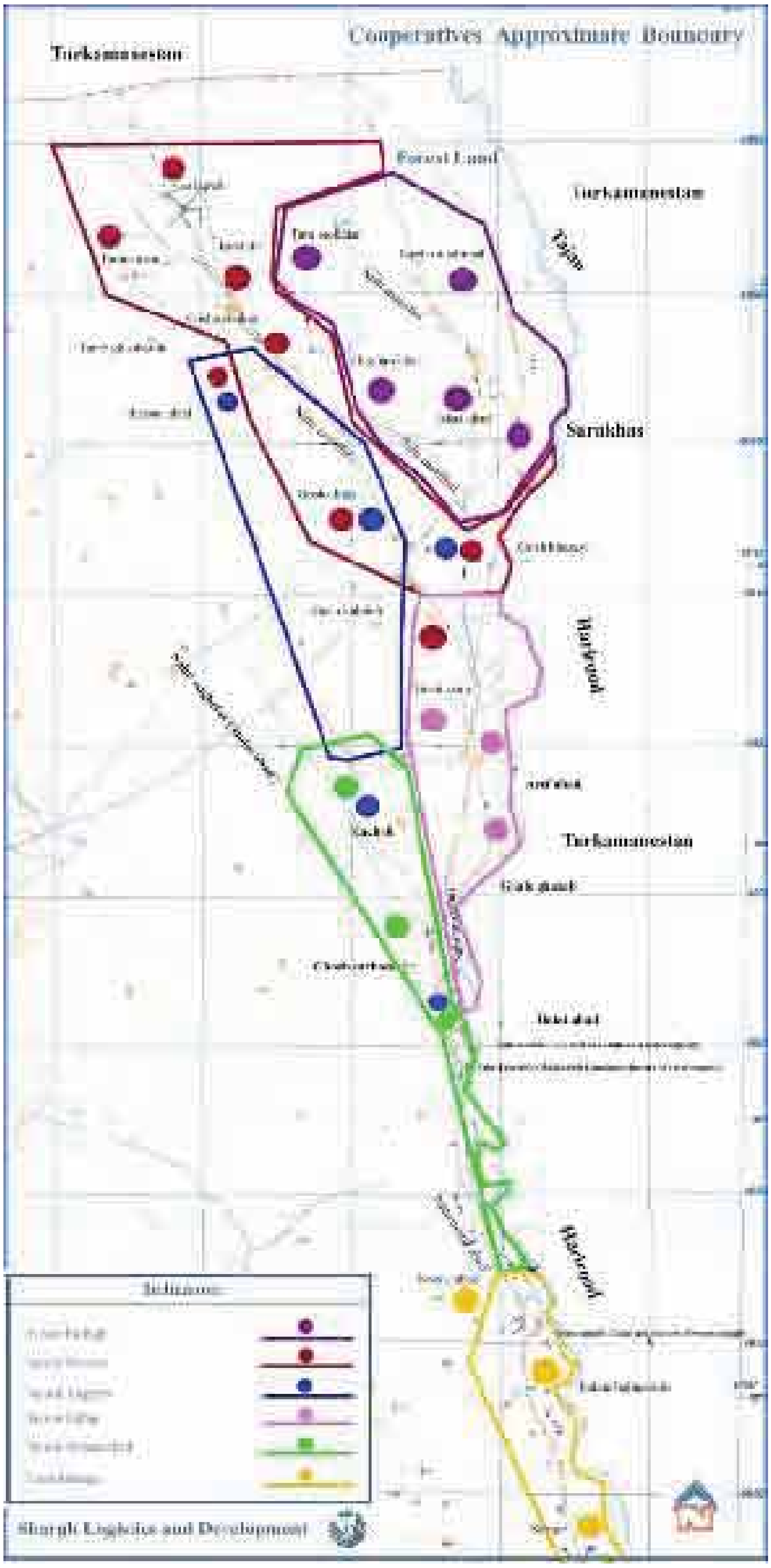


Table (3) Specification of WUCs at down stream of Doosti Dam

Item	Stream Name	WUCs name	Number of villages	Number of water right users	Land with water right (Hectare)	Amount of water allocated (mCu metre)
1	Mozaferi	Etehad	4	309	1440	4.7
2	Mozafari	Etefagh	5	879	4873	15.5
3	Mozafari	yavaran	7	1164	5562	18
4	Enghelab	Vahdat Tajan	5	323	1211	5.4
5	Nowruzabad	Nowruzabad	5	395	1899	4.9
6	Sangar	Sangar	3	186	682	2.2
Total			29	3256	15667	50.7

THE MAIN OBJECTIVES OF THE WATER USERS COOPERATIVES

1- Decreasing the government role in water management (in relation to chapter 1, according to the law in the Third Iran Development Plan)

2- The complete execution of the law for fair distribution of water, approved in March 2006.

3- Executing the objectives of the government manuals on optimum use of the agricultural water

4- Executing the objectives of the long guidelines of Iran water resources approved in December 2003 by the government.

5- Executing the approved decisions of the High council of Water (HCW).

6- Improvement of water usage and distribution of water

7- Assigning people affairs to themselves. The people seldom refer to regional water companies.

8- Cooperation in the issue of the water documents.

9- Facilities made by the manager of WUCs to refer to the banks on behalf of the farmers to receive loan for participatory construction of the networks.

Controlling and monitoring the usage of underground and surface water

Protection of underground and surface water with attention to the allocated investments

10- Assuring assuring the water rights of the farmers and preventing illegal water use.

11- Offering the services needed by the land

12- Owners, water right users and free water users by the cooperatives.

13- Making questionaires and getting general opinions of the farmers for decision making

14- And transfering information to the water users effectively.

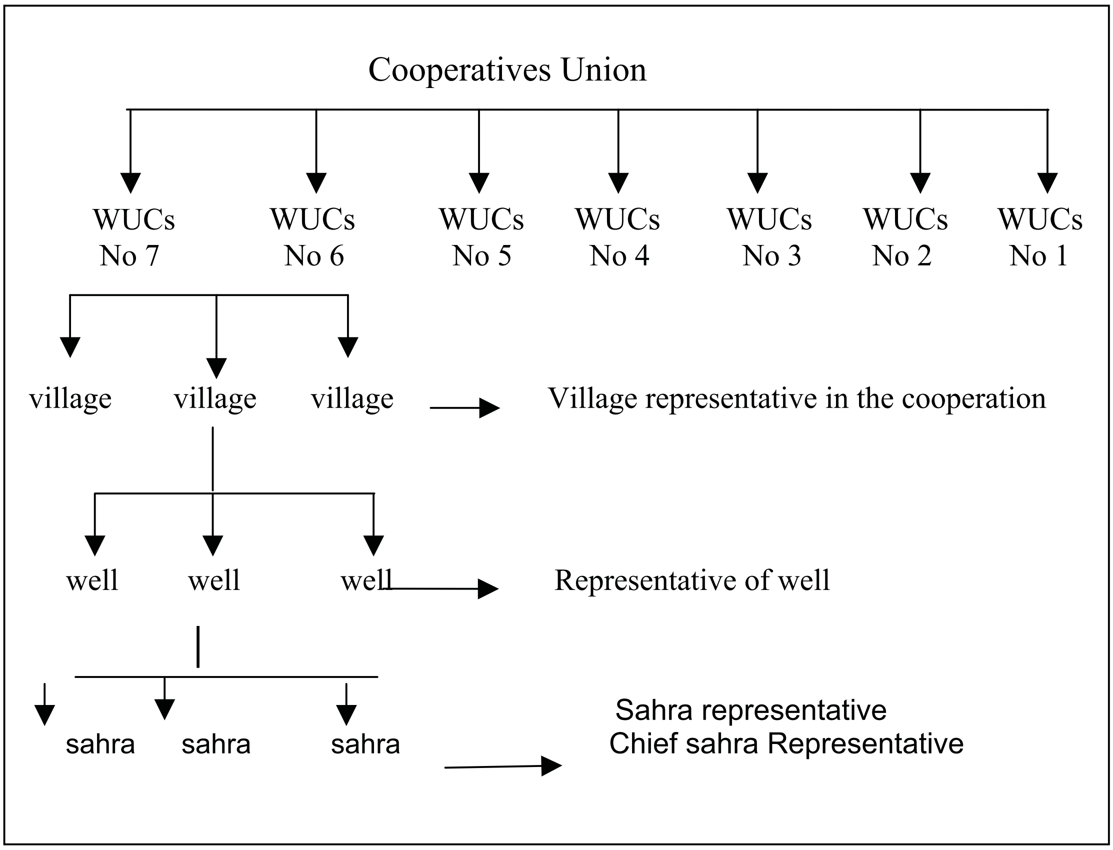
15- Making contract on behalf of all water users with the regional water companies to collect water fees.

16- Cooperation on land purchasing from farmers on the routes of the water canals, lining and the dams construction.

THE NEW STRUCTURE FOR THE MANAGEMENT OF WATER AT THE DOWN STREAM OF THE DOOSTI DAM

After the construction of the Doosti Dam and formation of water users cooperatives, the new structure of water management replaced the traditional system. The new management that is going to be fixed, needs two years time for controlling and training the WUCs managers and monitoring the system so that the new system be fixed as a mixture of new and traditional system. The following model of management has been suggested by the consultant and is being executed in the region.

Chart No.2 New structure of WUCs management on the down stream of Doosti Dam



THE ACTIVITIES DONE BY THE WUCS SINCE THE ESTABLISHMENT:

- Distribution of 60 million cubic meters of agricultural water.
- Decreasing the complaints of the framers on water distribution
- Clearing the old and unused canals by the WUCs: because of this activity and clearance of irrigation canals by WUCs, Iran could use her own relative share of water from the Doosti Dam
- WUCs have a central office in the city of Serakhs
- Lining the surface of the streams bottoms to prevent the linkage of water from some part of streams.

THE FINAL RESULT:

The formation of six WUCs in Serakhs, despite the existing particular problems as described below, was successfully finished in one year. The cooperation of consultant, governmental authorities and the local managers of the regional water company of Razavi Khorassan was the reason for expedition in following the legal steps and prompt formation of cooperatives.

The problems existed were as the following:

1- The sensitiveness of the region because of its location at the border.

2- Existing particular problems between the farmers and Astan Ghods Razavi on the matter of land ownership.

3- Existing some social conflicts among the farmers for water.

During the following procedure of cooperatives formation, many consultative, technical and scientific meetings were organized with the participation of managing directors of the new established WUCs, to consult the technical procedures for distributing the water from the Dam to the end of streams.

Many streams that distributed water to the down stream in the past had been filled and were out of use .the first activity of the cooperative was to repair the streams for distributing the Dam's water. It was the most important participatory action. With cooperation of the dam manager and the water company authorities and particularly the cooperation of WUCs, the farmers could use the mechanical machines for clearance of the streams at the end of the year 2006. The formation of WUCs was the main reason for reducing the conflict on water and other social matters. Although the social conflicts have not been finished in Sarakhs, it will be eotdr during the draught years because of the shortage of water. One of the other important activity of WUCs was to prevent the water linkage from the some part of sandy streams by lining the bottom of the streams. The other important activity by WUCs was piping and making the opening leads at the beginning of each stream that was done by the cooperation of WUCs and the Regional water company of Razavi Khorasan. Many social and political factors such as the boundary location, different local originations, different traditions, the difference of local income and poverty the region, independency of 100% of families to cultivation and agricultural activity, and the other similar problems, could prevent the formation of cooperatives, but a good collaboration and cooperation among people, governmental authorities and Astan Ghods Razavi proved this fact that collaboration and cooperation and participatory action can solve all the problems and can result a good benefit to the all.

Participatory work of the farmers in this project showed that they would be able to manage water use and water distribution and network construction or repairing by their own, if they had some governmental adviser with enough expertise and patient to advise and help them.

Of course it is obvious that WUCs would have many problems at the beginning because of the lack of experience or some miscollaboration but with more assistance and support to these cooperatives we are sure that they could do their job at the highest expected functions, and late or soon, these WUCs would be the sample of the successful water users association in whole the country of I.R. of Iran. As a consultant to regional water companies and the adviser in social and economic matters, I should recommend all water authorities of the country to extend their support and cooperation to the new established co-operatives for a few years. Be sure these people associations will be a good hand of executing projects to the government and by strengthening these cooperatives the country will simply reach her approved objectives in transferring water management, fair water distribution and optimum use of agricultural water.

ADDITIONAL PROBLEMS:

The legal relation between WUCs, the Ministry of Energy and the Regional Water Companies is not clear.

- At the present time the formation of cooperatives is financially supported by the regional water companies, but WUCs or any association are under the rule of the Cooperative Ministry or Labour Ministry and there is no legal relation between associations and the Regional Water Companies.
- IRAN Documents and Estates Registration Administration in her officially notice of recognition sends copies to 11 unit and organizations but no copy is sent to regional water companies that have most of cooperation before and after the cooperative establishment. Because there is no legal place of recognition for water companies.

SHORT-TERM SOLUTION:

The formation of cooperatives should be based on the permission of The Ministry of Energy (through the regional water companies) that means, if water companies of the region cancel their permission of cooperative formation, the cooperative practically is dissolved.

LONG-TERM SOLUTION:

Integrated views on the WUAs:

For increasing the ability of cooperatives so that WUAs be changed into an effective organization in water management, a multipurpose bill for WUAs should be proposed to parliament or at least, to the government. The approved proposal should be sent to governmental organizations and WUAs for execution.

TO MAKE THE ASSOCIATIONS MORE EFFECTIVE, AN OFFICIAL AND LEGAL RELATION SHOULD BE ORGANIZED BETWEEN DIFFERENT GOVERNMENTAL SECTORS AND THE WUAS

One of the negative view on the formation of the cooperatives is that their function is limited to collect the water fees and pay it to the regional water companies. This view should be improved among water users by strengthening and supporting them in such a way that they could be independent from the government while they are supported. The WUAs should be able to obtain income and become active in agricultural business. The collection of water fees should be their second or third function after being strengthened.

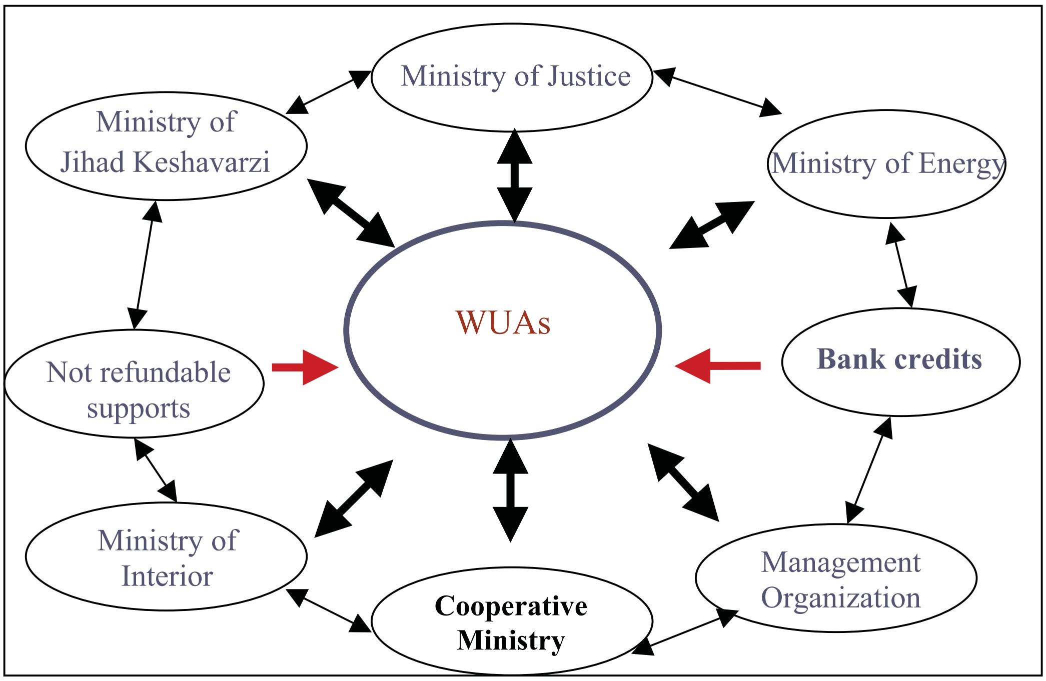


Chart 3: Capacity building of WUAs performance of article 107 of the third Iran development plan and article 17 of 4^{th} Iran development plan

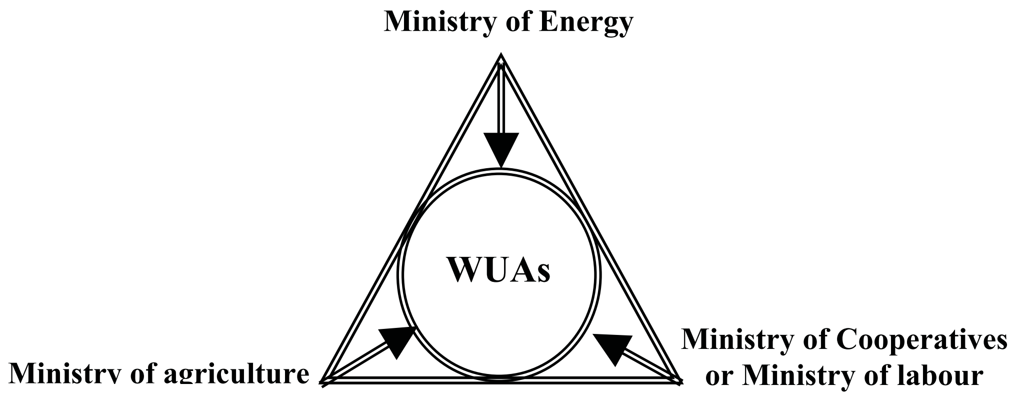


Chart 4: The main interrelation of WUAs with government ministries.

Notes:

1- This paper is derived from two projects at the down stream of Doosti Dam that was ordered by regional water company of the Razavi Khorassan. This is to thank the regional water company of Razavi Khorassan and all the researchers and persons who cooperated.

2- Article 107 of third Iran Development Plan:

"Government is allowed, in favor of execution the policy on economic use of water and the guidance of agricultural water users on optimum use of water, to provide water in streams or irrigation networks or pumping plants and deep and semi –deep wells on the basis of agricultural optimum water use to users and rating the price of water on the basis of the law for fixation of water fees .In this regard government will proceed on the written regulations and executive system for usage of water and participation of non governmental (right water users and owners) and formation of associations of water and soil users.

SOURSES

1- Trikar-Jan, Pole, (Persian translation – 1992), The problem of Rural development, Astan Ghods Razavi Pub., 552pages.

2- Hamed Moghadam, Ahmad, Faslanameh N0 21

3- Hamed Moghadam, Ahmad, An approach to new theories on Rural development, 1993, Geographical Research Quarterly, No.28

4- Iran Management and planning org., 2005, The Law of 4th I.R.of Iran development plan Persian), Vol. I, 6th Edition, 363 pages.

5- Iran planning and Budget, 1970, Khorassan Economic Development (Persian), Vol I Meshed, Scetcoop consulting Co. with cooperation of Partia engineering adviser.

6- Iran Planning and Budget, 2000, The 3rd I.R.Iran Development plan(Persian),154 pages.

7- Regional Water Company of Khorassan Razavi, 2006, The project of Recognition of Water Right users and determination of Water rights at the downstream of Doosti Dam – Serakhs(Persian), The Project Executor – Amayesh Consulting Co., Meshed.

8- Regional Water Company of Khorassan Razavi, 2006, The project of Water Users Association Formation at down stream of Doosti Dam- Serakhs (Persian), Project Executive: Amayesh Consulting Co., Meshed.

9- Safi Nejad, Javad, 1989, BONEH, Iran traditional management system (Persian), Amirkabir Pub., 584 pages.

10- Farhadi, Morteza, 1989, BonehShenasi, Previous review and critical views in formation of Boneh, Faslnameh 15.

11- Farhadi, Morteza, 2001, VAREH a kind of old traditional and feminine cooperative in Iran, Ministry of Jihad, Deputy for people participatory and promotion.628 pages

12- Iran National Committee for Irrigation and Drainage, 1998, World experiences of participatory irrigation management (Pub.No.20). 763 pages

13- Bryan Bruns and Helmi, 1996, Participatory Irrigation Management in Indonisia: Lesson from Experiences and issues for the Future, National workshop on participatory Irrigation Management, Indonisia

14- COPAC Open Forum, 26-27 October 1999, Successful cooperative models in East & Central Europe, Berlin

15- Gobal Naik, Amar H.Karlo, 1998, Two case studies on the role of Water Users ‘ associations in Irrigation Management in Maharashtra, India

16- Groenfeldt D. and P.Sun, 1997, Demand Management of Irrigation systems through Users Participation, Participatory Management Workshop, 9-15, 1077, Colombia.

PARTICIPATORY IRRIGATION MANAGEMENT MODEL IN CIHEA IRRIGATION SCHEME, WEST JAVA PROVINCE, INDONESIA[1]

N. Darismanto, and A. Hafied A. Gany[2]

ABSTRACT

Despite the fact that irrigation development and management under the participatory irrigation management (PIM) approach has a long history in Indonesia, however, the initiative of PIM in modern term has only been experimented in Indonesia since the late 1990's. Given the nature of land holding pattern, which is mostly of small holder, the PIM Approach has ever-since been implemented to adjust with small land holding condition. The results have been varying in the level of successes. There has been a number of irrigation schemes proved to be successful in the PIM implementation, through there were also problems of effective collaboration with the water users' association (WUA), not the least of which was the traditional top-down approach prevalent at that time. However, lessons learned 'the hard way', are now influencing the Government towards a new participatory approach in irrigation development that is beginning to pay dividends.

Intervening from the top down in small holder irrigation development always involved difficulties – too many implementing agencies; long delays caused by bureaucratic procurement procedures; and a lack of counterpart contributions from the Government of Indonesia as a result of poor revenue generation of irrigated paddy. Compounding these administrative problems were the difficulties in establishing rural financial services for farmers, during which, more focus on irrigation infrastructure rather than on the participants. Nevertheless, the establishments of WUAs as well as water users' association federation (WUAF) and Principal WUAF (PWUAF) have been formally carried out in many irrigation schemes. The remaining obligations are on the

1- This paper is specially prepared for the 10th International Seminar on Participatory Irrigation Management (PIM), conducted concurrently with the 4th Asian Regional Conference of International Commission on Irrigation and Drainage (ICID), Tehran, Iran, May 2-5, 2007.

2- Mr. N. Darismanto, Dipl. PG (IRR) is a Senior Irrigation Executive Expert, the member of Board of Director of the Indonesian Chapter of International Network on Participatory Irrigation Management (INPIM-INA); Mr. A. Hafied A. Gany, Ph.D., P.Eng. is the President of INPIM-INA, and vice President of the Indonesian National Committee of ICID (INACID) for International Affairs. gany@hafied.org; secretariat@inpim-ina.org

empowerment of the established WUAs in terms of institutional, technical, as well as administrative capacities to maximize the associations' functions.

In an effort to optimize the remaining capacity of the WUAs to pursue the sustainable operation and management of irrigation schemes through PIM approach, this paper has been prepared based on field experiment model that has been successfully conducted by WUAs in Cihea Irrigation Schemes, under the intensive guidance of irrigation services of the West Java Province, Indonesia. A number of experiences of the implementation of the PIM model are described in this paper, including: the salient features of Cihea Irrigation Scheme characteristics; objective and mechanism principles of the pilot model; rights, duties and obligations of the WUAs, membership and organization structure; basic principle of the establishment of WUAs, WUAF and PWUAFs; empowerment of WUAs; collaboration mechanism; budgeting; as well as control, monitoring and evaluation of the PIM implementation. It is expected that some of the PIM experiences presented in this papers are worth for comparative features in other regions or irrigation schemes that are having the similar characteristics.

Key Words: PIM Model, Water Users Association, WUA, Cihea Irrigation Scheme, West Java.

I. INTRODUCTION

In spite of the early initiative of participatory irrigation management (PIM) approach that has long been implemented in Indonesia, the initiative of PIM in modern term has only been experimented in Indonesia since the late 1990's. Given the nature of land holding pattern, which is mostly of small holder, the PIM approach has ever-since been implemented to adjust with the small land holding condition. During which, there were problems, among others due to the traditional top-down approach prevalent at that time. However, lessons learned 'the hard way', are now influencing the Government towards a new participatory approach in irrigation development that is beginning to pay dividends. Further to this, the establishment of WUAs as well as water users' association federation (WUAF) and Principal WUAFs (PWUAF) has been formally executed in many irrigation schemes. The remaining tasks are on the empowerment of the established WUAs in terms of institutional, technical, as well as administrative capacities to maximize the associations' functions.

In an attempt to optimize the remaining capacity of the WUAs to pursue the sustainable operation and management of irrigation schemes through PIM approach, this paper has been prepared based on field experiment model that has been successfully conducted by WUAs in Cihea Irrigation Schemes, under the intensive guidance of irrigation services of the West Java Province, Indonesia. A number of experiences on the implementation of the PIM model are described in this paper, including: the salient features of Cihea Irrigation Scheme characteristics; objective and mechanism principles of the pilot model; rights, duties and obligations of the WUAs, membership and organization structure; basic principle of the establishment of WUAs, WUAFs, and PWUAFs; empowerment of WUAs; collaboration mechanism; budgeting; as well as control, monitoring and evaluation of the PIM implementation. It is expected that some of the

PIM experiences presented in this papers are worth for comparative features in other regions or irrigation schemes that are having the same characteristics.

Through the actual implementation of PIM Model, the successful empowerment of WUAs is accomplished through a series of activities including socialization, motivation, training and visits, periodical meeting on the monitoring team office, facilitation, on-the-job training or comparative study, technical guidance, training, and other similar methods that are suitable with the local condition. Therefore, the implementation approach has been based on local needs, actual social-economic condition, as well as institutional capacity to perform, and monitoring results with periodical updating based on performance assessments.

The mechanism of WUAs empowerment is conducted by addressing all the stages of the empowerment units of the Regency or Municipal levels down to the field assistance units and farmer's assistant taskforce, as well as other units that are responsible for irrigation technical backup and/or implementation of funding support for PIM from the local government – as if available. In this regard, all of the farmers' assistance officers referred to is functioned as motivator, mediator and facilitator for a maximum of one year, after recruitment through a certain selection criteria.

1.1. BACKGROUND INFORMATION AND GENERAL PIM POLICY

Concerning the irrigation operation management in Indonesia, the Law No. 7 of 2004 about Water Resources, prescribes in Article No. 41 and No. 64, as well as in the Government Regulation No. 20 of 2006, on Irrigation, Articles No. 16,17 and 18, that the development and management of primary and secondary irrigation system is executed by the government and local government with the participation of WUAs based on their demands and capacities in terms of institutional, technical as well as funding availability.

The follow up participation of WUAs on the development and management of irrigation is based on the principle of active participation on all phases of PIM process from initial deliberation, decision and the implementation of planning, development, upgrading, operation and maintenance (O&M), as well as rehabilitation activities of irrigation system concerned. The terms of development and management in the PIM approach are meant to support land productivity for increasing crops production, national food security and stability program as well as for enhancing public prosperity of the water users in particular and for the entire communities in general.

The policy instrument further prescribes that the empowerment of WUAs has to be conducted by institution or agency of the respective regency or municipality concerned with irrigation, by which, the implementation must continuously encompassing institutional, technical, administrative, as well as budgetary aspects that had been mutually approved.

To test the effectiveness of the above mentioned irrigation policy, the implementation of PIM pilot model has been situated in the Cihea Irrigated Scheme, West Java Province with a special scrutiny on the enhancement of the WUAs' performances in the already available irrigation infrastructures and already established WUAs.

1.2. OBJECTIVE OF THE STUDY

The objective of the study under the Cihea PIM Experimental Model is to test the actual implementation of irrigation policy instrument and thereby prepare a draft of guideline manual for empowerment of WUAs in implementing the PIM with the necessary terms of implementation of obligations and of detailed procedures of WUAs/ WUAF on the management of irrigation by virtue of PIM approach. Parallel with the preparation of the guideline manual for empowerment of WUAs, the experimental model also intended to strengthen the WUAs in Cihea Irrigation Schemes toward a more powerful and independent water users' association in managing their irrigation infrastructures on the basis of sustainable PIM, in the Scheme – and expected to be replicated in the neighboring areas.

II. SALIENT ACTIVITIES OF THE CIHEA IRRIGATION AREA

2.1. GENERAL DESCRIPTION

The Cihea Irrigation Area as the study area for this PIM Model is the oldest technical irrigation scheme in Indonesia, which was constructed during the Dutch Colonial Government in 1879, and only fully completed physically in 1904. However, the irrigation scheme was only started to function 10 years later in 1914. One of the major constraints of the development was that the area, during the development period, was once the source of malaria that could only be eradicated after the country's independence in 1945.

The irrigation service area of Cihea Scheme is located on two districts government administrations which are the Bojong Picung and the Cirajang Districts with a total irrigated area for paddy at 5,484 ha. Based on the provision of Law No. 7 of 2004 concerning water resources – Article No. 41, prescribed that an independent irrigation area having a total command area of larger or equal to 3,000 ha is subjected to the government's authority for operation and management. Thus, the Cihea Irrigation Scheme falls into the category of the government managed irrigation scheme, comprised of 3,292 ha taking its water from the Cisuru/Cisokan weir at the Cisokan River; and the other 2,192 ha command area from Ciranjang weir at the Ciranjang River, together are having an overall discharge capacity of about 7.00 m^3/second. Based on the above mentioned irrigation policy, the government consistently operate, maintain and improve the irrigation networks by applying for PIM approach. The construction approach involves the WUA (*Mitra Cai,* in local term) – a joint cooperation between the public and community is carried out in the form of Irrigation Management Cooperation (IMC).

2.2. IRRIGATION INFRASTRUCTURES

Under the PIM approach, it is very important that the irrigation services together with the water users under the coordination of WUA, makes a routine inventory of all the irrigation infrastructures (irrigation structures, conveyance and drainage canals as well as other supporting and appurtenance structures) that support the effective irrigation water distribution and management activities. The routine inventory and updating of the underlying status of irrigation infrastructures allows the irrigation officers and the stakeholders to comprehend more exact figures about operation, maintenance and budgetary requirement of the entire activities.

In order to perform irrigation water distribution for the command area of 5,484 ha in the flat undulated most and flat plain, the Cihea Irrigation System is equipped with two intake weirs, three major diversion structures, 10 outlet structures, 96 drop structures, 11 water measurement structures, 9 measurement flumes, 22 water supplying structures, 146 tertiary units and 23 culverts at the drainage channels. The entire main system canal network (both conveyance and drainage canals) has a total length of 74.70 km, and about 20 km of inspection road along the major canals.

2.3. OPERATIONAL AND MAINTENANCE ACTIVITIES

Consistent with the national irrigation policy instrument, the O&M as well as management of irrigation infrastructures in Cihea Irrigated Area for intake weir, primary canals and secondary canals are conducted by the Branch Irrigation Service (Regional Coordinator III -- Korwil III) Ciranjang. The Regional Coordinator III is responsible to help empowering the WUAs, whereas the management of tertiary networks is handed over to the WUAs to perform independently.

Water Distribution System: For simplification, the irrigation water distribution of the Cihea Irrigation Scheme is compounded into three Groups. These are: Group I = 1,863 ha, Group II = 1,852 ha, and Group III = 1,769 ha. A regular biweekly meeting for determining the water allocation and distribution is conducted by the Branch Irrigation Services/Korwil. During this regular meeting, determination of water requirement is decided through mutual calculation of the crop water requirement for the next periods. Subsequently, the water discharge for the following period is determined in accordance with the mutual calculation of the plant water requirement. Based on determined discharge, the magnitude of water volume for individual tertiary irrigation unit is implemented by making use of water measurement devices in every outlet gates on the tertiary unit. From this point downward the water distribution management is entrusted to the local WUA for irrigating the farm blocks.

O&M Tasks: The “Operation” and “Maintenance” activities of irrigation are regarded as the two sides of the coin, which is mutually co-existence, and hence cannot be separated. In this regards, **“operation”** of irrigation involves a number of activities, including the water distribution management, operation of the water measurement gates, measurement and recording the volume of water distribution through water measurement devices, conducting water distribution and the necessary coordination amongst the WUA members. On the other hand, the **“maintenance”** of irrigation involves a number of physical works including the regular maintenance of embankment, patching the leakages of conveyance channel, lifting the silt deposit on canal bottom, weirs and other irrigation structures, grass cutting, weed and garbage removals lubrication and painting of water gates, periodical maintenance and normalization of the canal wetted perimeter, replacement of water gates and stop-logs as well as other such activities, including emergency O&M endeavors.

2.4. CROPPING PATTERN

The cropping pattern and schedule which apply in the Cihea Area have been based on the mutual approval between the government and irrigation stakeholders through annual meeting of Irrigation Commission at the regency or municipal level. The mutual commitment for cropping pattern is endorsed by the local government through the formal Regent's decree. For example, the result of the 2005's meeting has been endorsed by the Regent Decree No. 521/Kep135-PSDAP/2005 concerning cropping pattern and schedule of the drying period on irrigation area for annual maintenance (covering a total area of 5,484 ha, having 26 villages within two district government administration). The overall cropping patterns and irrigation schedule stated in the above Regent's Decree are outlined as follows: (1) Planting season I, mainly for paddy with the total area of 5,484 ha; (2) Planting season II, which also for mainly paddy for a total area of 5,484 ha; and Planting season III, which is projected for the mixture of the second crop at 3,220 ha and 2,260 ha proposed for dry season paddy. The irrigation schedule is presented in **Table 1.** as follows:

Table 1. Cropping Pattern and Irrigation Schedule of the Cihea Irrigation System

Plantation Schedule (PS)	PS I	PS II	PS III
Cropping Pattern I	01-10-05	16-02-06	01-07-06
Cropping Pattern II	16-10-05	01-03-06	16-07-06
Cropping Pattern III	01-11-05	16-06-06	01-08-06
Notes: Based on the production data of 2005, the actual yields of the crops based on the above cropping pattern are as follows: (1) PS I with the yield of 6.00 to 7.00 tons/ha of dry grain paddy; (2) PS II with the yield of 5.00 to 6.00 tons /ha of dry grain paddy; and PS III with the yield of 4 tons/ha of dry grain paddy on an area of 2,260 ha; and an average of 0.8 tons/ha on 3,220 ha of second crops (ground nuts, corn, soy beans etc.)			

2.5. PRESENT STATUS OF WUA *(MITRA CAI)*

For actual implementation of PIM approach in the Cihea Irrigation Area, a total of 65 WUAs units has been established, out of which, 40 units in Bojong Picung, and 25 units in Ciranjang Area. For facilitation of effective coordination the WUAs are jointly incorporated into three WUA's Federation, (WUAF) which are: (1) WUAF *Tirta Walatra* with 21 WUAs units; (2) WUAF *Karya Sejahtera* with 21 WUAs units; and (3) WUAF *Sabanda Sariksa* with 23 WUAs units. These three WUAF are further incorporated into a Principal WUAF, which is referred to as the Principal WUAF *Tirta Mulya Rejeki.* The PWUAF is responsible to coordinate the entire WUAs' (IP3A, in local abbreviation) activities, as if requested on actual demand basis.

III. PRINCIPLES AND FEATURES OF WUAS UNDER THE PIM APPROACH

3.1. Principles and Characteristics

For supporting the actual implementation of PIM, the establishment of WUAs together with the subsequent empowerment is the most important prerequisites. The establishment must meet the special characteristics, among others as follows: (1) WUAs are based on the principle of *gotong-royong* (mutual aid); (2) WUAs are based on a social-economic community with special awareness on sustainable environmental concept; (3) WUAs are institutions with distinct characteristics including; (a) Self maintenance capacity for physical, social, cultural as well as economic characteristic; (b) Capable of preserving the local wisdom, knowledge and indigenous technology inherited from their ancestors – such as utilization of locally available technology and resources; (c) Willing to adopt external technology and knowledge having sufficient capacity for adjustment with indigenous knowledge and technology.

Objectives of WUAs, WUAF, and PWUAFs: The primary objectives of WUAs establishment are among others: (a) To organize the development and management of irrigation system on tertiary irrigation networks; (2) To participate in the development and management of primary as well as secondary irrigation system; (3) To accommodate problems and farmer's aspiration related to water issues for their farming business; (4) As an umbrella organization of the farmers for communicating their thoughts, insights and problem-solving alternatives; (5) To provide services for meeting the demands of farmers especially for adequate irrigation water; (6) To facilitate representation of the farmer in cooperating with external parties including local government or other institutions.

Meanwhile, the objectives of the WUAF's establishment are among others: (1) To coordinate the WUA members on their commanding area in participating with the development and management of irrigation systems; (2) To coordinate the participation of its member in distribution, allocation as well as water utilization; (3) To facilitate representation of the WUAs on the Regency/ Municipal Irrigation Committee as well as in the Provincial Irrigation Committee. With regards to the PWUAF, its establishment is specially carried out by coordinating of several WUAFs within a large independent irrigation scheme or large block of main system, based on actual demand principles.

3.2. URGENT DEMAND FOR WUAS' EMPOWERMENT

Considering the institutional and policy reforms on irrigation, which have been suffered from uncertainties within the last few years, it has been quite unfortunate that the process of policy reform has been going very slowly, while the day-to-day activities of PIM, particularly of WUAs' empowerment cannot be postponed. As a result, the activities have been conducted without special policy guidelines – with obvious consequences of highly diversified achievements. As soon as the policy instruments have been enacted, the PIM activities together with their related aspects must be adjusted immediately. This includes the immediate demands for empowerment of WUAs as the following policy outlines: (1) The empowerment of WUAs/ WUAF has to be geared toward self propelling institutional capacity (technically, socially and financially), so that it could actively involved in the development and management of irrigation by means of PIM approach. Nevertheless, given the functions and tasks of

WUAs in the development and management of irrigation which differs from the WUAF's empowerment, therefore, the empowerment processes of both institutions have to be address in parallel terms. (2) The empowerment of WUAs within irrigation system has to be systematically undertaken in such a way that the institution could perform their interdisciplinary tasks and responsibilities -- technical, social-economy, organizational as well as financial – with special focus on the related prerequisites among others: i) Assurance of the legal status of the organization, acknowledgement of the rights and responsibilities of its members, procedure of management implementation, acknowledgement of its presence as well as its responsibility on irrigation management on their respective working areas; ii) Assurance of the technical capability on irrigation management and farming activities; iii) Assurance of financial capability and management to refrain from dependency attitude; iv) Assurance of their entrepreneurship capacity for supporting the organizational obligation to sustain operational as well as management activities of their organization. This includes the necessary collaboration with other technical as well as non technical units at all levels, as are demanded by the PIM implementation.

IV. INSTITUTIONAL ARRANGEMENT

4.1. RIGHTS AND RESPONSIBILITIES OF WUAS AND WUAF

In order to assure the institutional capacity of both the WUAs and the WUAFs to undertake effective organizational arrangement, there have to be a clearly defined right and responsibility of the board of management, among others as the following responsibilities: (1) To implement the rules and regulation of the organization; (2) To provide the necessary organizational supports and facilities, including the effort to appeal resources supports from the local government as well as from other external funding organizations; (3) To facilitate the necessary cooperation with external organization, including the government related institutions; (4) To facilitate mutual dialogues for approval of PIM implementation, such as construction of new infrastructures, collective coordination, collaboration and working arrangement mechanism.

Water Use Right: Under the terms of institutional arrangement, the WUAs / WUAFs are entitled to irrigation water use right from irrigation turnout gates. For the case where the WUAs/ WUAFs have yet established – the water use right is deliberated in the form of water allocation to the management board for subsequent delivery to the relevant tertiary irrigation turnouts.

For assurance of judicious and fair water allocation, the WUAF has a special responsibility to settle water disputes or to facilitate democratic voting (if necessary) for determination of water allocation through the regular Irrigation Committee Meeting at the regency/municipal or provincial levels. The WUAF also responsible for facilitating joint proposal for cropping patterns, system and irrigation schedule, acquiring of collective irrigation water allocation and so on.

Rights of WUAs and WUAF Members: (1) To obtain irrigation services based on the availability of water source; (2) To put up objection for the case of water allocation is not meeting the mutually agreed schedule; (3) To allege entitlement to elect or to be elected as being the member of board of management; entitlement to management audit; and entitlement to give suggestion in relation with the development and management of irrigation system.

4.2. ACCOUNTABILITY MECHANISM OF THE WUAS AND WUAFS

Periodical Meeting: The terms of accountability of the WUAs and WUAFs are formulated through periodical meeting, which are meant to set up the terms and accountability mechanism as follows: (1) To formulate and establish the bylaws and constitution; (2) To establish and review of organizational structure; (3) To engage and disengage from Board of Management; (4) To formulate implementation program; (5) To organize on-demand meeting for determining the terms and the magnitude of O&M contribution, collection mechanism, resources management and financial accountability; (6) To determine the types of violations and the subsequent sanctions; (7) To confirm, approve or disapprove the report of board of management; (8) To organize special meeting for formulating the term of cooperation with the third party, if any.

Obligation of WUAs and WUAFs Members: In order to assure the effectiveness of organizational arrangement, it is essential that all of the members of the WUAs and/or WUAFs aware about their obligation, and the consequences of management problems should the member neglect their membership obligation.

The terms of obligation of WUAs and/or WUAFs' members are among others: (1) To comply with the bylaws and constitution of the WUAs; (2) To comply with the underlying laws and regulation; (3) To determine and set up the coordination mechanism for development, O&M of the tertiary irrigation schemes, including the implementation of the related activities such as water allocation, usage and disposal of excess water within the tertiary irrigation block; to collect O&M Fees; (4) To establish the demanded WUAFs for facilitating coordination amongst WUAs with another parties including the relationship with the local government concerned.

Entitlement of WUAs and/or WUAF's member: Like most organization, the active members of WUAs and/or WUAF are entitled to: assure and maintain the effectiveness of irrigation infrastructures; consistent payment for subscription in terms of O&M service fees; and to comply with the organizational bylaws and constitution.

Responsibility of WUAs and WUAFs Management: For maintaining the constant flow of organizational arrangement, the management of WUA and/or WUAF have to implement the organizational activities they are responsible for, including among others: (1) To manage and conduct the consistent development and management of tertiary irrigation scheme, including the routine collection, management and financial account; (2) The management of WUAs/ WUAF coordinates their members for participation in the development and management of irrigation system on secondary and primary networks; (3) To execute sanctions to the member for any violation of the underlying regulatory instrument; (4) To undertake the necessary settlement of disputes; (5) Providing for the best possible services by means of fair, transparent and judicious water distribution in conformity with the actual availability of water.

4.3. DETERMINATION COMMAND AREA'S JURISDICTION

The jurisdiction area for WUA or WUAF varies from one irrigation scheme after another, depends upon the hydrological and physical characteristic of the irrigation service area of the irrigation schemes in questioned. For example, determination of command area's jurisdiction of the WUA is based on tertiary irrigation area, or on physical boundary of the village as agreed upon by the members. Meanwhile, determination of the command area's jurisdiction of WUAF is usually based upon hydraulic boundary of secondary blocks. Otherwise, it may be based on an individual irrigation area in accordance to the mutual agreement of the association's member. For the Principal WUAF (PWUAF), determination of command area's jurisdiction is commonly based on primary blocks or based on an independent irrigation area, in accordance with the mutually agreed consensus amongst the members.

4.4. MEMBERSHIP CRITERIA AND ORGANIZATION STRUCTURE

Membership: The members of WUAs are all farmer which directly benefited from the tertiary irrigation service or a village irrigation area comprised of: the owner, pond's owner which acquire its water from irrigation and other institutions using irrigation water. The members of WUAFs are all representations of WUAs units on a secondary block service area, a collection of several secondary blocks or an independent irrigation area. While the members of PWUAF are all representations of WUAF *(GP3A)* on a primary block service area, a collection of several primary blocks or an irrigation area, with an addition of their representation at a minimum of one third of the total WUAs on every cluster of WUAs.

Organization Structure of WUAs and WUAFs: Since the WUAs and WUAF are comprised of members and management units as well as sub units, therefore, the organization structure is mostly determined and established collectively through the general assembly meeting. The management structure for the case of Cihea Irrigation Scheme comprised of President, Vice President, Secretary, Treasurer, Technical Commission, Block Chairman or Quaternary unit's CHAIRPERSON.

4.5. ESTABLISHMENT OF WUAS AND WUAF

Water Users Association: In general, the basic rule of establishment of WUAs is based on the principle *"from the initiative of the water user, by the water user, and for the user"* all are conducted by means of transparent and democratic rule. On the basis of this approach, the water users come up to an agreement to establish a WUA, having determined its own management, Institutional arrangement and code of ethics, as well as bylaws and constitution. For formal term, the establishment of WUAs, together with the subsequent management, Institutional Arrangements, bylaws and constitution through a formal general assembly meeting, and the result of assembly shall be reported by the president of WUA to the Local Regent or Mayor in charge. The next process is the management of WUA registers their Institutional arrangement, bylaws and constitution of the association to the State Court for obtaining the formal or at least registered legal status.

WUAF (Water Users Associations' Federation): Similar with the principle of the establishment of WUAs, the WUAF are also established based on the principle of *"established from, by and for several WUAs together on a secondary blocks/service area or a part of irrigation area"* by means of democratic rule. Whereas the management and its member comprises of the representation of WUA unit within the secondary block in questioned. At the initial stage several WUAs located on a secondary block entered into an agreement to form a WUAF, establish a management board and formulate institutional arrangement as well as drafting the bylaws and constitution. The establishment of WUAF, management board, institutional arrangement as well as bylaws and constitution are officially endorsed on an assembly meeting and shall also be reported by the management / WUAF chairman to the local Regent or Mayor. The established WUAF is subsequently functioned for coordinating of several WUAs within a secondary block or the cumulative service area of several irrigation areas in participating with the development and management of irrigation within the jurisdiction area. Similarly, the establishment of PWUAF at the larger secondary or larger irrigation scheme by making consensus amongst several WUAFs to form PWUAF for conducting coordinative activities of the WUAF.

V. EMPOWERMENT OF WUAS

5.1. EMPOWERMENT APPROACH

The empowerment of WUAs and WUAF is related to two main issues. These are: (1) Strengthening of internal organization by applying for democratic and transparent rule including the effort to acquire a formal but justifiable legal entity to fully independent in implementing the justifiable irrigation management within the relevant jurisdiction area; (2) Facilitating the enhancement of organizational empowerment including the development of self propelling capacity in technical, financial, managerial, administrative and organizational aspects to be able to be independently managed its own irrigation area on the basis of sustainable operation and management.

In an attempt to put the above two issues into a realistic and workable plan of action, the approach must carefully consider both the technical and non-technical elements which are highly decisive to the successful implementation of PIM approach. These include: (1) The principle of partnership, transparency, democracy, accountability, and the extents of law enforcement in the O&M activities; (2) Consideration of the approach for fostering a sound planning through participatory measure, without disregarding the environmentally friendly technology and local resources as well as indigenous technology; (3) Consideration of the non technical aspects that are associated with socio-cultural conditions, as well as other intangible parameter; (4) The empowerment, as far as possible shall be oriented on the actual needs and interests of the WUAF; (5) The empowerment of WUAF is to be implemented on the basis of sustainable approach by means of effective, efficient and sustainable participatory irrigation management.

Sequence of Empowerment Process under the PIM Approach: Upon confirmation of mutual commitment for empowerment of WUA, the actual implementation by employing PIM Approach, a series of activities has to be undertaken through sequential activities ranging from socialization and public consultation concerning the PIM to the local government agencies together with the existing WUA members.

For fact finding and identification of actual status and physical conditions of irrigation infrastructures, the empowerment unit together with the WUA's members conduct mutual-check along the entire parts of irrigation system referred to as *"walk through"*. The overall result of the work-through will give an overall picture of irrigation infrastructures, including the demand for improvement, O&M activities and the estimated budgetary requirement of the O&M and improvement activities. Based on the results of the *"work-through"* the empowerment unit, local government representative together with the WUA's members, make further efforts to carry out participatory irrigation design for subsequent O&M activities by involving the WUAs. This process requires a series of meetings and dialogues to finalize and confirm the design for actual implementation.

For further arrangement, sharing of the roles and responsibility, the meeting assigns the working group to coordinate the implementation of participatory O&M and construction activities, as well as monitoring evaluation of the entire process of WUA empowerment in accordance with the implementation schedule that had been mutually approved along the PIM process. (For illustration, see the series of photographs of the implementation of the PIM approach, presented in the **Annex**)

5.2. SCOPE OF EMPOWERMENT

The scope of empowerment of WUAF comprised of institutional aspects indicated are amongst the legal statuses of the organization, managerial capability, management involvement and the number of active members. While the technical aspects comprised of technical aspects such as: (i) Land acquisition method; (ii) Simplicity but effective principle and the use of applied technology, especially for water measurement devices; (iii) Practical method for water management allocation; (iv) Appreciation of the local technology that has been applied successfully in the area in questioned.

5.3. Empowerment Target

The target of empowerment is the establishment of WUAs, WUAF, and PWUAF which are independent in terms of organization, technical, financial and their participation on developing and maintaining irrigation system and supported by the government as facilitator and dynamic-stimulator through programs which meet the demands of each organizations. These include: (1) Organizational aspects such as the establishment of WUAs, WUAF, and Principal WUAF making use of the locally specified characteristic; (2) **Irrigation Technical aspects**, with special scrutiny on the assurance of the empowerment capacity to achieve the well-maintained and well-functioned irrigation networks; (3) **Human resources capacity** through the WUAs to be able to participate on the activities of development and management of primary irrigation system and its secondary system; (4) **Agriculture Technical Aspects** including the capacity to increase and maintain the intensity of high value crops through an efficient water management; capacity to minimize the unjust competition between upstream and downstream parts of irrigation scheme; to be capable of enhancing sustainable crop productivity through efficient irrigation water and crop management.

5.4. FINANCIAL SUSTAINABILITY FOR SUPPORTING EFFICIENT IRRIGATION O&M.

Based on long term experiences, it is considered that the accomplishment of financial sustainability of WUAs is almost impossible without own capacity to collect funds at the minimum of 50% of the need based budget for the main system; the minimum capacity to collect at least 70% of the actual service fees from the members for O&M subscription. For the WUA level, they have to be financially independent for generating O&M fee from within the organization, including the empowerment of the WUAs in order to be capable of accessing funds from reliable financing institutions for healthy investment.

5.5. GOVERNMENT COMMITMENT

Based on the long terms experiences to implement PIM approach under the small land holding irrigated farming condition, it has been clearly observed that such the small land holding condition is highly sensitive to the risk of marginalization of the already marginal farming condition. Therefore, it is somewhat unrealistic to rely fully on the marginal irrigated farming condition for fully recover the costs of appropriate operation and management without external support from the government.

It is therefore highly essential for the availability of empowerment program in the form of training, dissemination of information, learning by doing based on the need based budget of the WUAs, WUAF, and Principal WUAF to be supported partially or fully through the full commitment of the government.

VI. CONCLUDING REMARKS

Learning from actual implementation of PIM Model in Cihea Irrigation Scheme, the empowerment of WUAs has evidently accomplished through a series of interrelated as well as integrated activities including: socialization, motivation, training and technical field visits, implementation of periodical meeting on the monitoring team office, and facilitation of dialogues amongst the relevant organization with PIM activities. The subsequent empowerment of WUAs for implementing PIM approach has also been quite effective by facilitating actual working experience such as on-the-job training or comparative study from the more successful example. The technical guidance and training have been more effective through the learning by doing process, with a series of adjustments with other similar methods that are suitable with the local condition.

Based of the field experiment on the implementation of PIM approach in Cihea irrigation Scheme it has been concluded that the determinant factors for successful empowerment of WUAs are dependent upon the institutional capacity of the implementing agency together with the irrigated farming community to identify the local water management demands that are conducive to actual socio-economic conditions. The most apparent determinant factor of success is also significantly demonstrated by the institutional capacity of the empowerment unit together with the WUAs to perform consistent periodical monitoring activities, and subsequently making use of the monitoring results as well as periodical data updating based on the performance assessments, and making the necessary adjustment and improvement in accordance with the updated performance assessment.

In accordance with the need to comply with the decentralization policy, the mechanism of WUAs empowerment is conducted by addressing all the stages of the empowerment units of the Regency or Municipal levels down to the field assistance units and farmer's assistant taskforce, as well as other units that are responsible for technical backup and/or the implementation of funding support for PIM from the local government. However, this approach has to be insisted only as far as the local condition is conducive enough to meet the empowerment approach. In this regard, all of the farmers' assistance officers referred to is functioned as motivator, mediator and facilitator for a maximum of one year, after a certain selection criteria. During the initial process of the massive implementation of PIM approach, it has been the case in Cihea Irrigation Scheme that the Field Assistance Units (who are the most upfront change agents) are amongst the government commissioned on the field which functioned to give immediate technical and administrative support for irrigation water management at the tertiary irrigation networks.

The actual irrigation water management at the tertiary distribution has to be undertaken by irrigation personnel given full trust to the farmer under the WUAs to manage the farm level irrigated agricultural technology (*sapta usaha tani)* with the distance supervision and coordination of the village head, as if mutually considered necessary.

In addition to the Field Assistance Unit, the farmer's assistance officer also play an important role for the implementation of PIM approach in Cihea Irrigation Scheme given special function as motivator, mediator and facilitator for mobilizing the farmers' capacity to implement PIM approach through WUAs at the maximum of one year with the optional follow up extension services, depending upon the actual field demands. To meet the above personal capacity demand, the recruitment of farmers' assistance offices must strictly consider the minimum criteria as the following examples criteria that have been experienced in the Cihea PIM model: (1) To have adequate knowledge, skill, and practical experience on the field of rural economy with the minimum education of bachelor degree; (2) To have adequate skills on the field of irrigation operation with the minimum of bachelor degree on irrigation engineering; (3) To possess special skill and experience on the field of institutional and law enforcement related to irrigation practice; (4) To be recruited based on the actual demand of WUAs and subject to the availability of fund support from the local government; (5) Willing to stay with farmer at the assigned site, on full-time basis, for a maximum contract term of one year or more, subject to the demands for follow-up extension services.

LIST OF REFERENCE

1. Bruns, Brian and Helmi, 1996. Participatory Irrigation Management in Indonesia: Lessons from Experience and Issues for the Future. A background Paper for the National Workshop on PIM, Prepared for the World bank EDI, 1996.
2. Directorate General of Water Resources Development, Ministry of Public Works in collaboration with The Economic Development Institute, The World bank. *"Proceeding of National Seminar on PIM"*, Jakarta November 1996.
3. Republic of Indonesia, 2006. *Peraturan Pemerintah No. 20 Tahun 2006, Tentang Irigasi.* (Government Regulation No. 20/2006 about Irrigation).
4. Republic of Indonesia, 2004. Undang-undang No.7/2004 tentang Sumber Daya Air. (Law No. 7/2004 concerning Water Resources)
5. Republic of Indonesia: UU No. 22/1999 *Tentang Pemerintahan Daerah* (Law No. 22/1999 about Regional Government Administration); UU No. 25/1999 *Tentang Keseimbangan Pendapatan Pusat dan Daerah* (*Income balance between Central and Local Government*); UU No. 32/2004 *tentang Pemerintahan Daerah* (Law No. 32/2004 about Decentralization of Government Administration*);* UU No. 7/2004 tentang SDA; PP 22/1982 Tentang "Tata Pengaturan Air"; PP No. 20/1990 *tentang "Pengendalian Pencemaran Air"* (Water quality Management); PP No. 29/1986 *Tentang AMDAL*; PP No. 35/1991 *Tentang Sungai* (River management); PP No. 27/ 1991 *tentang Rawa"* (Swamp Land Management); UU No. 11/1967 *tentang Pertambangan* (Mining); UU No. 5/1984 tentang Perindustrian (Industries).
6. Vermilion, D.L., and Brewer, J.D., 1999(?) Participatory Action Research to Improve Irrigation Operations: Examples from Indonesia, International Irrigation Management Institute, Colombo, Sri Lanka.

ANNEX

(Photographs of Empowerment Process under the PIM Approach in the Cihea Study Area)


Step I. Illustration of socialization of PIM involving the WUA members, and empowerment unit of the local government concerns with the Cihea Pilot Model.


Step II. Illustration of the ***"walk rough"*** to identify the actual status, and condition of irrigation schemes, including demands for O&M, improvement works and actual budgetary requirements.


Step III. Illustration of the Participatory Irrigation Design using the actual data that has been obtained through the ***"walk-through activity"***, involving the stakeholders from the early stages.


Step IV. Illustration of the follow up meetings and regular dialogue to reach consensus.

Step V. Illustration of the discussion for establishment of working group, sharing of roles and responsibility in the implementation of PIM approach.

Step VI. Illustration of the mutual work activities for conducting maintenance works, canal improvement and other physical activities of irrigation O&M.

Step VII. Illustration of the finalization of mutual work activities of maintenance works, canal improvement and other physical activities of irrigation O&M.

Step VIII. Illustration of the Evaluation of PIM activities after the routine monitoring of the entire activities, followed by improvement actions.

A CASE STUDY OF FOUR FARMERS ORGANISATIONS IN MANAGEMENT OF IRRIGATION SYSTEM IN INDIA

C.M. Tejawat[1] and R.S. Gupta[2]

ABSTRACT

Four Water Users Associations (with 1618 ha culturable command area and 575 farmers) were formed in Gudha Medium Irrigation project, Rajasthan, India. Rehabilitation of the canal system by WUAs and handing over of these canals to farmer's organizations has resulted in 34% to 41% saving in canal running days in the year 2003-04 as compared to 1997-98. This has been mainly achieved due to management of irrigation system by Farmer's Organizations and rehabilitation of canals. It was also found by sample cutting of various crops that the yield of Sugarcane, Wheat, Pea (vegetable), Lentil, Gram, Mustard and fodder increased to the tune of 40.19%, 58.14%, 54.02%, 84.73%, 19.23%, 25.00% and 51.77% respectively in the year 2003-04 as compared to 1997-98 after initiation of Participatory Irrigation Management activities.

The recoveries of irrigation charges by the WUAs were as high as 93.23% for current dues and 52.23% for old dues of Alod minor. Over all recovery of four minors by WUAs was about 8% higher over recovery of remaining minors of Gudha Project during 2000-01. Similarly in the year 2001-02 the average recovery of all the four minors made by the WUAs was 30.8%. The reason of less recovery was that the farmers were not ready to deposit old dues pending since a long. The annual expenditure on operation & maintenance was 18% to 49% of the recovery made by water user associations during the year 2001-02. It shows surplus revenue with all the WUAs after the introduction of PIM.

1. INTRODUCTION

India's largest state Rajasthan is predominantly an agrarian state. Over seventy per cent of the population depends on the agriculture sector. Overall economy of the state largely depends upon the performance of agriculture sector, which in turn, cannot be assured without irrigation. Surface as well as ground water resources of the state are scare and rainfall in most parts of the state is low and uncertain.

1- C.M. Tejawat, Assistant Director (Monitoring), Command Area Development, Kota (Raj.) India email: tejawatcm@yahoo.com Phone: 91-94141 79609
2- R.S. Gupta, Joint Director (Agri.), Irrigation Management & Training Institute, Kota (Raj.) India

Gudha Medium Irrigation Project (District Bundi of Rajasthan), was constructed in the year 1958 across river Mej, a major tributary of river Chambal. The Dam is an earth fill Dam, 23 m high above the river bed. The Project is located at Longitude 76^{o} 26’ 30” and Latitude 25^{0}56’0”. The CCA of the Project is 10390 ha and irrigation is done through two main canals off taking from left flank and Right flank of the dam. The length of Right Main Canal and Left Main Canal is 27.6 Km and 25.80 km respectively. Right Main Canal has one Branch canal named as Hulaspura Branch and 9 minors where as Left Main Canal has 10 minors.

2. ACTION RESEARCH UNDER FINANCIAL ASSISTANCE FROM WORLD BANK

Under the Agricultural Development Project of the World bank four minors of the Gudha Medium Irrigation Project were taken up to motivate the farmers, to form Water Users Association under Action Research program of the Irrigation Management & Training Institute, Kota (Raj.) India, involving deferred maintenance, rehabilitation and PIM activity. These four minors namely LMC Minor No.1, LMC Minor No. 2, Alod Minor and Danta Minor were having total culturable command area of 1618 ha and 575 farmers.

Formations of Water Users Associations (WUAs) on these minors were initiated with an awareness campaign and group meetings with farmers to make them aware & understand the concept of participatory irrigation management (PIM). With subsequent persuasion, the farmers of these four minors responded favorably and about 70% farmers (as against the more than 50% requirement to form a society) agreed to take over the responsibility of irrigation system. These four WUAs (**Table 1**) were registered under The Rajasthan Co-operative Act along with election of nine executive committee members.

Project reports for all the four Minors amounting to Rs. 39.25 lakhs were prepared and clearance of the World Bank was received.

Table 1: Details of Water Users’ Associations on Gudha Medium Irrigation Project

S. No.	Name of Minor	CCA (ha)	Number of	
			Farmers	Members
1.	Alod Minor	251	125	80
2.	Danta Minor	536	150	115
3.	LMC Minor No. 1	367	135	110
4.	LMC Minor No. 2	464	165	95
	Total	**1618**	**575**	**400**

As an initial step, the WUAs were given the full responsibility of ordinary repairs, jungle clearance and de-silting of the Minors as well as Water distribution during Rabi 1998-99, which they completed successfully. It was found that the small work of canal clearance and undertaking irrigation management by WUAs, have resulted in better irrigation, enabling first watering to be completed at a much faster rate and in lesser time as compared to past years as indicated in the **Table 2**.

Impressed by the quality of work and feedback received from farmers, transparency of work and involvement of WUA members, World bank agreed, rather recommended that rehabilitation works be also got executed through respective WUAs. The objective of giving complete rehabilitation to WUAs was to train the WUA members for doing maintenance & rehabilitation works in future as they will shed their sweat for execution and it will generate affinity towards the system. At the same time there will be transparency in entire execution of rehabilitation works.

Table 2: Details of First Watering done by WUAs

S.No.	Name of Minor	Discharge* (cusec)	Number of canal running days		Saving of canal running days
			Year 1997	Year 1998	
1.	Alod Minor	9.46	33	22	**11**
2.	Danta Minor	15.12	19	18	**1**
3.	LMC Minor No. 1	14.01	35	28	**7**
4.	LMC Minor No. 2	14.03	37	24	**13**

*Prior to Revision of L-Section of Minors.

The state government provided a relaxation as a special case for these minors, in the provisions of Public Works Financial & Account Rules and permitted all works of rehabilitation to be got executed by respective WUAs. An advance of 20% of the amount of work order was provided as financial support to these WUAs.

3. PLANNING OF REHABILITATION WORKS

The rehabilitation works on four minors was done by respective WUAs including following major steps:

- Nature and type of works to be done were discussed among respective WUA members.
- Since it was a time bound program, various WUA members were assigned specific jobs to execute.
- Looking to the major problem of water distribution below outlets and over-out letting, revision of network planning was essential. Hence it was essential that

each chak (area irrigated by a single outlet) was actually re-assessed and outlet size / location fixed as per actual.

- Re-designing the operation plan to cater revised network planning without changing discharge at head of each minor.
- Prioritize the works proposed in the project report and also addition works if found essential outside project provisions to meet out actual needs of farmers.
- Place work-wise work orders, in order of priority fixed, release 20% advance payment against work order amount and retain 10% of the cost as WUAs contribution towards rehabilitation works.

4. REDESIGNING OF OPERATION PLAN OF THE SYSTEM

One of major deficiencies in canal irrigation of these four minors was uncontrolled supplies and irregular distribution of water from head to tail. To over come this situation a systematic approach was evolved. The stepwise procedure followed was as follows:

- One-day workshop was organized for WUA executive members to explain in detail the procedure of rehabilitation.
- General body meeting of all the four minors were organised to assign the responsibilities of work to each WUA member to carryout general repair work.
- Joint walk through survey was conducted with WUAs members to identify the works requiring rehabilitation. Prioritization of works on each minor was conducted looking to the budget estimate.
- Walk through survey of each minor was also conducted to reassess the command boundaries and to mark the outlet, turn out, field channel alignment and to mark boundary of the chak (area irrigated by single outlet).
- The data so collected from field was discussed with each WUA by conducting series of meetings.
- It was also assured to the WUAs that as far as possible the irrigation system will not be disturbed, however they will have to run their outlets rationally and as per revised operation plan prepared to suit the revised situation.
- Accordingly revised capacity statements of each Minor were prepared.
- Wherever necessary suitable water control structures were provided.
- All outlets above cross regulator were provided with gates & some outlet below cross regulator were also kept as gated for early closing of outlets.
- All outlet gates were provided with locking arrangements.

- It was envisaged that entire area would be irrigated within 16-17 days after release of water from the head of minor.

- These revised plans were again discussed with farmers & suitable amendments wherever needed were made.

- All such decisions were taken in weekly meeting held with WUAs on every Wednesday to avoid unnecessary paper work & to ensure total transparency.

- All the fall structures were so designed so that sufficient working head is available at outlets. Crest levels of fall structures were worked out and incorporated in the revised L-section.

5. EXECUTION OF REHABILITATION WORKS

After the chak plans were reviewed and revised, location, size and numbers of outlets reassigned with full involvement of members of concerned WUAs, L-section and hydraulic parameters of all the four minors were re-designed to suit revised operation and water distribution plan amongst outlets, without increasing discharging capacity of their head regulators to influence operation of their parent channels. Details of outlets before & after rehabilitation were as follows:

Table 3: Comparative Statement of authorised, existing and finally proposed outlets.

S.No.	Name of Minor	C.C.A. (ha)	Number of Outlets		
			Before Rehabilitation		As per Rehabilitation Plan
			Authorised	Existing including Cuts	
1.	Alod Minor	251.00	13	45	27
2.	Danta Minor	536.00	11	41	21
3.	LMC Minor No.1	367.00	16	62	34
4.	LMC Minor No.2	464.00	19	60	41
	Total	**1618.00**	**59**	**208**	**123**

The average C.C.A. per existing outlet varies from 9.31 hectares to 25.52 hectares. This variation in C.C.A. per outlet was mainly due to local topography.

Provisions of various works taken in the project reports of all the four minors were also discussed with members of concerned WUAs and after giving due consideration to their own needs, some more works were also agreed to be executed, most of such additional works comprised of:

- Lining of some more reaches, of course after technically re-examining their necessity
- Construction of a few more Village Road Bridges / foot bridges.

- Improvement of service roads by raising their levels above (at least upto) Full Supply Level in Minors and putting a layer of quarry spells.

Due to above additional works and escalation (prevalent market rates), cost of all the rehabilitation works rose to Rs. 62.31 lacs.

Execution of work was conducted by respective WUAs with technical support from irrigation department. Weekly meetings were held in the project area itself to review progress of works and sort out problems if any. This has minimized traditional paper work for obtaining necessary approvals on issues related to Administrative, Technical & Financial matters.

With the completion of all the rehabilitation works, all relevant records of all the four minors including chak plans, canal operation plan and revenue record were handed over to the executive committee members of each minor along with the handing over of management of all the four minors, duly rehabilitated and brought to the designed standard to respective WUAs for their operation, maintenance, assessment & recovery of irrigation charges.

6. PERFORMANCE OF WUAs AFTER HANDING OVER SYSTEM TO THEM

Complete operation & management of irrigation system was handed over to the WUAs from rabi season 1999-2000. It was expected that WUAs will operate canals as per operation plan handed over to them and they shall regulate cross regulators and outlet gates accordingly. It was also presumed that WUAs executive would make the assessment of irrigated (crop wise) and will raise the demand and recover the same from respective farmers, as all revenue record was also handed over to them.

From the data of **Table 4** it can be concluded that about 34% to 41% saving in canal running days in the year 2003-04 was observed as compared to 1997-98. This has been mainly achieved due to management of irrigation system by Farmer's Organizations and rehabilitation of canals.

Table 4: Comparative Statement of water saved.

S. No	Name of Minor	Number of canal running days.						Saving of water in the year 2003-04 as compared to 97-98	
		Year 97-98	Year 98-99	Year 99-2000	Year 2000-01	Year 01-02	Year 03-04	Days	%
1	Alod Minor	89	31*	51	35 **	42	54	35	39.33
2	Danta Minor	89	31*	52	45**	57	52	37	41.57
3	LMC Minor No.1	79	28*	66	39**	54	51	28	35.44
4	LMC Minor No.2	82	28*	74	49**	62	54	28	34.15
	Total/Av.	339	118	243	168	215	221	128	37.76

Note:-

- Running days for pre-sowing irrigation + 2 irrigations
- *Due to shortage of water in Dam, only one pre-sowing irrigation was provided;
- ** Due to less availability of water in dam & for feeding tails during the year 2000-01, number of canal flow days for all the four minors were curtailed.
- During 2002-03 water of the Dam was reserved for drinking purpose. No irrigation was provided.

It was also found by sample cutting of various crops that the yield of Sugarcane, Wheat, Pea (vegetable), Lentil, Gram, Mustard and fodder increased to the tune of 40.19%, 58.14%, 54.02%, 84.73%, 19.23%, 25.00% and 51.77% respectively in the year 2003-04 as compared to 1997-98 after initiation of Participatory Irrigation Management activities. Before implementation of PIM the productivity of the wheat was 2.60 m tones per ha, which has increased to 59.65%, 49.57%, 67.07% and 56.14% on Alod, Danta, LMC Minor #1 and LMC Minor #2 respectively.. The area of high water requirement crop of Sugarcane has reduced to a greater extent and has increased under low water requirement crops like Pea (vegetable) and wheat.

The recoveries of irrigation charges by the WUAs were as high as 93.23% for current dues and 52.23% for old dues of Alod minor. Over all recovery of four minors by WUAs was about 8% higher over recovery of remaining minors of Gudha Project during 2000-01. Similarly in the year 2001-02 the average recovery of all the four minors made by the WUAs was 30.8%. The reason of less recovery was that the farmers were not ready to deposit old dues pending since a long.

The annual expenditure on operation & maintenance was 18% to 49% of the recovery made by water user associations during the year 2001-02. It shows surplus revenue (**Table 5**) with all the WUAs after the introduction of PIM. Reason of less O&M expenditure was that these canals were rehabilitated during the financial year 1998-99 and hence less maintenance was required. The saving with WUAs could be utilized in future.

Table 5: Details of Irrigation Recovery and Expenditure on Maintenance of the Canals by four Water Users' Associations on Gudha Medium Irrigation Project

S. No.	Name of Minor	CCA (ha)	Recovery (%)	In Rs per ha	
				Recovery	Expenditure
1.	Alod Minor	251	65.69	208	38
2.	Danta Minor	536	39.94	100	36
3.	LMC Minor No. 1	367	20.34	80	39
4.	LMC Minor No. 2	464	25.21	94	40
	Total	**1618**			

A social survey was conducted in the year 2000-01, by interviewing personally 115 farmers out of total 575 farmers (**Table 6**) to know the functioning of WUAs and response of beneficiaries. Survey included member as well as non-member farmers (farmers who were receiving water from these canals but were not ready to became member of WUAs by paying small contribution). Total 399 members (65%) and 176 non–members (35%) were interviewed. To maintain the homogeneity, 40 numbers of farmers from head reach, 35 farmers from middle reach and 40 farmers from tail reach were interviewed.

Table 6: Details of Socio Economic Survey of PIM Activities at Gudha Medium Irrigation Project

S.No.	Item	Unit	Name of Minor				Total
			Alod	Danta	LMC Minor No.1	LMC Minor No.2	
1.	**Total number of farmers**		125	150	135	165	575
1(a)	Member of WUAs	No.	82	113	105	99	399
1(b)	Non Member of WUAs	No.	43	37	30	66	176
2.	**Farmers Interviewed**						**Average**
2(a)	Members of the Society	%	56	67	78	59	65
2(b)	Non Members	%	44	33	22	41	35
2 (c)	Head Reach Farmers	Nos	8	7	16	9	40
2(d)	Middle Reach Farmers	Nos	8	7	10	10	35
2(e)	Tail Reach Farmers	Nos	9	10	11	10	40
	Total farmers Interviewed		**25**	**24**	**37**	**29**	**115**

Results of the data collected have been summarized in **Table 7**. From these data it is clear that about 86% farmers were of the opinion that they have been benefited by the implementation of PIM activities in their irrigation system. Similarly, 82% farmers said that they were informed in advance about the operation schedule of the canal, which was generally not present in the previous management system. About 79% farmers were of the opinion that management of irrigation system by WUAs was better as compared to the government-managed system, whereas 19% farmers didn't found any difference in the management of the irrigation system. One of the important finding was that 98% farmers said that they did not had any conflict about water distribution and all the farmers received the water in their fields on time. Similarly, 98% farmers replied that they were aware about the functioning of WUAs in their area.

Table 7: Results of the Socio Economic Survey of PIM Activities at Gudha Medium Irrigation Project

S.No.	Item	Unit	Name of Minor				Total
			Alod	Danta	LMC Minor No.1	LMC Minor No.2	
	Farmers Response to Four Major Questions						
1.	**Weather benefited by PIM activities?**						
1(a)	Yes	%	100	92	68	83	85.75
1(b)	No	%	0	8	32	17	14.25
2	**Were they informed about the operation schedule of canal in advance?**						
2(a)	Yes	%	80	79	86	83	82
2(b)	No	%	20	21	14	17	18
3.	**Was management of system better as compared to Govt. management system?**						
3(a)	Better	%	68	79	87	83	79.25
3(b)	No difference	%	32	21	5	17	18.75
3(c)	Previously it was better	%	0	0	8	0	2.00
4.	**Were there any conflicts about water distribution?**						
4(a)	No	%	100	96	100	97	98.25
4(b)	Yes	%	0	4	0	3	1.75
5	**Do you know whether WUA is working in your command?**						
5(a)	Yes	%	100	100	92	100	98.00
5(b)	No	%	0	0	8	0	2.00

7. CONCLUSIONS

Operation and Management of irrigation system by farmers' organizations at four minors of Gudha Medium Irrigation Project has given encouraging results. Social survey of 115 farmers out of total 575 farmers showed that they have been benefited by the functioning of WUAs (about 86% farmers), they were informed in advance about the operation schedule of the canal, management of the system was found to be better (75% farmers) as compared to the previous way of management, conflicts among farmers about water distribution has been almost nil (98% farmers) and 98% farmers were knowing the functioning of WUAs in their area.

It was also found from the data collected that WUAs were able to save canal running days by 37.76% (34 to 41%) in the year 2003-04 as compared to 1997-98. No dispute in water distribution among the cultivators was observed after Participatory Irrigation management activities. The yield of Sugarcane, Wheat, Pea (vegetable), Lentil, Gram, Mustard and fodder has increased to the tune of 19.23% to 84.73% . Over all recovery of four minors by WUAs was bout 8% higher over recovery of remaining minors during 2000-01. Similarly in the year 2001-02 the average recovery of all the four minors made by the WUAs was 30.8%. The annual expenditure on operation & maintenance was 18% to 49% of the recovery made by water user associations during the year 2001-02. It shows surplus revenue with all the WUAs after the introduction of PIM.

8. REFERENCES

Status Report, 2003-04, Participatory Irrigation Management Activities in Gudha Medium Irrigation Project, Dist. Bundi., Irrigation Management & Training Institute, Kota , Rajasthan (India).

A SUCCESSFUL EXPERIMENT ON PARTICIPATORY IRRIGATION MANAGEMENT IN IRAN

Mansoureh Eslami[1]

ABSTRACT

In southwest of Iran, in Khuzestan province there is an irrigation network with about 7600 hectares gross areas which is under private sector. This network that was constructed in 1950, supplies its water requirement from Ojiroob River with $14m^3/s$ (maximum discharge); so it is known as Ojiroob Network. The network consists of a diversion dam with three gate and 3 m^3/s discharge, 6/8 km. main canal (soil coverage) and 8 km secondary canal and main drain. All network's structures have been built and are operating by South Agricultural Corporation.

This network is managed fully privately by board of directors of South Agricultural corporation with no interference from any governmental organs. Corporation's shareholders and the board of directors are both owners and local farmers of the rural area. The corporation is in charge of all water supply, conveyance and distribution works, canal and dam protection and repairing, and farmers are as its customers who sell water in cheep rate and without any control.

The annually network's operation cost is at least about $45000 which is met by shareholders and users' (water rate payment). But maintenance and operation costs of network are too expensive to be met only through these sources. The public sector has taken no efficient action in protection of network either in giving loan, or financial and technical aids to the corporation. Thus, in recent years this corporation has encountered financial crisis in the network maintenance.

Considering the network's conditions and functions, as a good pattern for encouraging the private sector and farmers' participation in irrigation management, it is essential to solve its problems and make efforts for its survival. Hence, in addition to receiving technical and financial support for the network optimization, it necessitates to construct water control structures and water usage according to volumetric units.

1- Manager of new technology affairs, Khozestan Water & Power Authority, Ahvaz, Iran
Tel.:0098 - 611 - 3360527 Fax: 0098 - 611 - 3364191 E-mail: eslamimns@yahoo.com

PREFACE

In recent years, by improving the process of designing and constructing irrigation networks, thousands of hectares of cultivable lands in Iran have gone under the irrigation networks coverage. Khuzestan province with more than 280,000 hectares of the network area has the maximum proportion. Besides the existing technical problems and limitations which have made operation associated with many problems, other obstacles such as policy making and legislations, current management structures, social and cultural conditions, also farmers knowledge and training level has eventually made irrigation network operation as a complicated and uneconomical activities so that government is imposed to pay huge costs for the networks operation and maintenance.

To escape from these growing problems, various strategies have been developed on basis of improving organizational structure and management of water sector, legal and legislative mechanisms, developing proper infrastructures and cultural context to attract water users, and private sector participation in constructing and operating irrigation networks. In Khuzestan, there is successful and worthy management experience in regard to private sector participation in irrigation.

South Agriculture corporation (S.A.co) was established in north of Khuzestan province by local farmers and land owners about 60 years ago. Due to constructing and managing Ojiroob irrigation network, this corporation, is considered the oldest Iranian private corporation which is active in modern irrigation network, perhaps it is a unique sample. S.A.co's structure and performance also its problems and accomplishments can be a paradigm criteria for assigning construction works and irrigation network management to private sector and for developing required programs and policy makings in this regards.

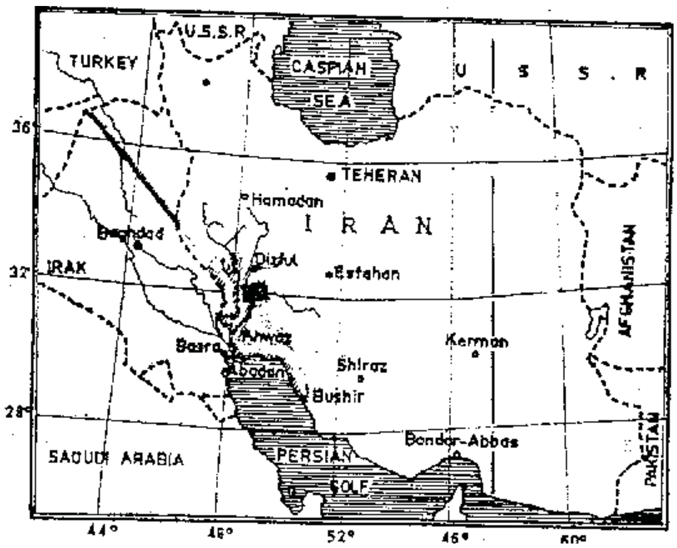
HISTORICAL BACKGROUND AND SITUATION OF OJIROB IRRIGATION NETWORK CONSTRUCTION

In 1948, S.A.co was established by major land owners and local farmers. The corporation focuses on operation from water and soil resources and agricultural development by using the law of land farms assignment. In 1949

According to formal contracts between corporation's members and government, 7650 hectares of areas around Ojiroob River and its water right were assigned to this corporation for land reclamation and construction. S.A.co. according to item 1 of mentioned agreement called for constructing a diversion dam on Ojiroob River and a network of preliminary and secondary earth channels on its lands according to Mana consultant engineers' design as well as monitoring from Independent Irrigation Institute. Before that, these lands were cultivated in dry lands.

Ojiroob network is located of 25 km to south of Dezful city, also Ojirob River and a part of Dez River are flowing at west of them.

In 1949 studies regarding Ojiroob irrigation network including diversion dam construction and network channels were accomplished by Mana consultant engineers. Furthermore the irrigation network and dam construction works were started in 1950. Independent Irrigation Institute undertook monitoring all of design and construction stages.



TECHNICAL SPECIFICATION OF OJIROB IRRIGATION NETWORK

Gross area	7650 hectares
Net area	5500 hectares

Network components:

***Diversion dam:**

Type of dam	concrete – diversion
Dam height from the river bed	7/30 m
Constant water surface level	65/91 m asl
Crest length	20m
Number of spillway gates	3 gates with 3 cms capacity
Type of gates	metal – slide gate
Gate size	5*4/10m
Maximum discharge	20cms

*** Irrigation network**

Conveyance (main) canal length	6/8 km
Length of the secondary canals	8 km
Number of inlets	2 sets
Input discharge average	10 cms
Maximum canal capacity	14 cms
Canal lining	earth canal

Upstream of diversion dam and canal intakes

Downstream of diversion dam

Although the network design consultant engineers have considered constructing a pumping station on 5 km of main canal inlet in order to water provision for the west areas of network. This design didn't implement in reality. Instead diversion weir was constructed at that location, hereto this action led to many problem regarding downstream water supply and canal maintenance for the farmers and the corporation.

IRRIGATION NETWORK MANAGEMENT AND OPERATION

S. A. co. the owner of Ojiroob Irrigation Network, is in charge of management and operation of this network. Its major members are general meetings of shareholders and board directors who are elected by all the members for 2 years. The office of corporation is located in the largest village of the area. About 1500 hectares of network lands belong to the members and the rehabilitation and construction secondary, tertiary and quarter nary canals costs are paid by themselves. The remaining lands assigned gradually to the local farmers, are irrigated by traditional secondary canals. The operation and maintenance of the network are in the hands of corporation. Network water demands are supplied by diversion dam and conveyance canal. Water flows through the canals full time (24hours) and there is no control on users' water consumption

Besides the farmland requirements in this area, the corporation undertakes to supply required water for sugar cane farms of block E of Karun Plantation and Industry Company.

LAND USE PROCEDURES IN OJIROOB AREA

Since Ojiroob network is adjacent to the largest Iranian irrigation network (Dez), local farmers follow current crop pattern in Dez network areas and land use procedures in the area is similar to this network. The existing farmlands at S. A co. is cultivated by following two season pattern crops:

Winter-Spring crop: wheat, under plastic crops, (eggplant, cucumber, and tomato), sugar beet, strawberry, lettuce, onion, snap bean, carrot, potato and autumnal watermelon.

Summer crop: milo, bean, tomato, rice.

Prevailing crops in this region are wheat in winter and milo in summer.

WATER SUPPLY AND DISTRIBUTION

In the first decade of network's operation, the entire network and lands belonged to the corporation's shareholders, so water allocation was accomplished based on obtained agreement and land ownership ratio of each shareholder, and the members were fully responsible to pay their annual subscriptions. After Land Reclamation in1963, the major part of those areas was assigned to farmers gradually. According to the permission from K.W.P.A. (Khuzestan Water and Power Authority) and Agriculture office, this corporation took water rates from formers according to %25 of winter yields (wheat) and %15 of summer yields (rice).

After Iran Revolution (1980), because of the changes in social relations and condition, legislation, land ownerships and farmer's disputation it was difficult to determine water rate and farmers hardly paid it. Non-payment of water rate resulted increasing breakdown and corrosion of the network structures. With the corporation's members continuous follow-up and according to Dezful governor's recommendation, it was determined to pay water rate on the basis of cost of 125 kg wheat per hectare in each cultivable season.

However, despite very low water rate in the network, most of water users aren't willing to pay water rate except about %20 of them (mainly residents of local corporation village) because of non – transparent legislation for private irrigation network and lack of executive criteria .The corporation doesn't contract with farmers for water sale. Just receipt money and important information is recorded when farmers come to pay their debts.

There is not any control on water usage due to lack of measurement structures and control consumptions and 24 hours flowing water through the channels. Thus due to excessive waste water and low irrigation efficiency, irrigation canals and drainage system are deeply eroded.

CORPORATION'S PROBLEMS AND RESTRICTIONS

The most important problems which this corporation is involved with are different problems based on their type and origins as follow:

1- TECHNICAL PROBLEMS

- The lack of measurement structures and controls on farmers' water usage.

- Decline of conveyance canal's capacity, particularly at diversion weir (5km canal) because of intensive sedimentation, requiring continuous silt removal from the channels.
- Improper dimension of secondary channels, their soil lining and excessive growth of weeds on them,(in fact these channels are considered as traditional ditches)and too much water losses in these ditches.
- Negative effect of diversion weir on provision of required water for farmlands down-stream of conveyance channels
- Operation stage (incomplete construction of pumping station for conveyance channel, some of secondary channel’s and service road)
- Intensive damage and erosion at diversion dam abutments and support walls due to river bank ruin through downstream.
- Stilling basin and tail water distraction due to percolation of river bottom springs
- Dam gate rustiness and corrosion and also gate lifting system

2-FINANCIAL PROBLEM:

Financial issues regarding the network maintenance and essential repairing can be considered as the most important restrictions for the network operation. The corporation’s financial budget is provided only by the member’s subscription and farmer’s water rate payment. Considering the network's oldness and corrosion, keeping it safe even at the current situation is beyond the company's financial strength.

An accomplished evaluation indicates that the amount of the required annual budget is about $45000 only for keeping the network safe in its current situation and for its annual common maintenance (not essential).

Regarding the corporations limited financial resource, providing the budgets for the basic maintenance and rehabilitation of the network will be accomplished only via government and banks financial support although the corporation hasn’t already managed to do it because of ambiguity in legislation and various interpretations of laws.

In the last years, board of directors and some of the shareholders have inevitably spent their own funds for the network maintenance and durability.

On the other hand, because of continuation of increasing prices and costs for repairing due to corrosion, it can’t be expected that they can stand in this situation for a long time.

3-LEGAL PROBLEMS

The most important legal and legislative obstacles which the corporation was involved with are as the following:

- The existing supervisory and supportive laws in regard to the irrigation network operation focus on governmental management.
- Legislatures and bylaws ambiguity and non-transparency regarding nongovernmental irrigation management cause contradictive interpretation of laws.

- Lack of legislative guarantees and executive terms within non-governmental management activities in order to follow-up their demands and cutoff water consumption for users who do not pay water rate.
- The existing ambiguous laws and lack of executive bylaws are hindrances of private irrigation management to take loans of banks and executive organs' supports.
- The lack of proper legislative mechanism in the corporation to make contracts with farmers and follow-up their debts.

4- SOCIAL PROBLEMS:

The shareholders and the boards of directors who are native, having a long term background in local activities and a stable social status, are trusted and admired by local residents and farmers. While there is disagreement between the farmers or even familiar and ethnic problems they act as a dean or conciliator to settle their problems. Nevertheless, the viewpoint and performance of most of the farmers toward water rate and the operation issues, are influenced by their tradition, beliefs and social relations. The most essential problems and challenges in this regard are summarized below:

- The farmers' deep-rooted religious beliefs regarding God ownership on gift of nature including water, cause farmer's non-payment for water rate.
- The existing beliefs expressive of necessity of exerting obligation and pressure on some users to pay water rate constrainedly.
- Low level of farmer's social awareness and their unwillingness to participate in operation and maintenance of the network.
- Farmer's low literacy and their misunderstanding of laws and private irrigation management position.
- Misunderstanding of the private sector's position by water consumers and not considering a legal aspect for this sector.
- Indifference, non-cooperation and lack of necessary supports from local governmental institutes toward S.A. corporation activities.
- Easy access to water by users due to steady streaming water in the network with no control thus neglect of real value of water.

CONCLUSION AND SUGGESIONS

Considering the government strategies in order to attract farmers' participation in construction and management of irrigation networks, S.A.co with more than 50 years successful experience, can be evaluated in different aspects and the obtained results can be utilized for planning and proper pattern representation in the other part of country.

As mentioned before, this corporation has encountered many problems and constrains during the past years which have involved it in various crises. In spite of all that it can stand on its own. Where-as government sector with all its available support and possibilities, couldn't be successful in irrigation management so much. Perhaps we can summarize the secrets and reasons of its survival through the following cases:

- Necessity of network survival because it is the only resource to supply water to all region areas
- Formation of corporation's staff by local farmers and native land owners; thus their enthusiasm for agricultural activities.
- Corporation's members consider facilities and network structures as their own heritage and try to preserve them.
- Corporation's members are so rich and well-educated also familiar with agriculture scientific concepts and use new procedures and can have a large income.

It can't be denied that it is essential to maintain Ojiroob network for supplying water requirements in the region. However, the network survival involves offering financial and technical and, legal supports briefly as the following:

- Offering possibilities and bank loans for rehabilitation and basic maintenance of diversion dam and network structures.
- Making laws transparent and revision of the laws and bylaws to oblige relevant sectors responsible for incorporating with the corporation such as offering services and required supports.
- Construction of measurement and control structures and consultant and technical supports from scientific sectors and executive authorities in this regard.
- Developing a particular system and mechanism in the corporation in order to record water demands, computations, determining the water rate due to users' water right and following up delayed payments.
- Reviewing the determination of water rate, on the economic basis or at least on the basis of dominant relevant laws regarding governmental irrigation network (%3 yields per hectares), and providing a proper cultural context for farmers to agree with.

REFRENCES

1. MANA Consulting engineers co -1945- Technical Report of Dam Construction, Ojirob Irrigation Project- Tehran, IRAN
2. South Agriculture corporation memorandum approved 1948/26/6, Tehran: Iran
3. Visiting and interviewing with the company's board of director and its staff members.

IMPLEMENTATION OF IRRIGATION MANAGEMENT TRANSFER IN IRAN: A PROPOSED FRAMEWORK

Mehmood Ul Hassan[1], Asad Sarwar Qureshi[2] and Nader Heydari[3]

ABSTRACT

Iran is facing a serious water scarcity and the government is making serious efforts to adopt technical and institutional measures to meet the challenge. One of the key strategies being persuaded is the devolution of management responsibility to users. Thus Irrigation Management Transfer (IMT) has been adopted as a key strategy to improve the operation and maintenance, reduce losses and enhance sustainability of irrigation infrastructure. However, IMT efforts are at an inception stage and are largely happening in areas where infrastructure is under rehabilitation. The key objective of this paper is to review the on-going IMT efforts in the two provinces of Iran, as well as the lessons from the neighboring countries, and propose a viable framework for implementing IMT. To get the first hand information of the IMT activities in Iran, field visits were carried out in the provinces of Qazvin and Karmanshah where two big pilot projects are being carried out. At the end, paper proposes a framework for the implementation of Irrigation Management Transfer in Iran.

Keywords: Irrigation management transfer, Iran, water user associations, irrigation reforms, farmer organizations, water management

INTRODUCTION

The populations and governments of water scarce countries face the challenges of optimizing allocation and utilization of the limited water resources for food production, and rural livelihoods. The challenges are further compounded by the emerging competition from the non-agricultural uses, and the environment (Molden and Boss, 2005). Governments tend to revisit their policies and introduce institutional reforms to re-allocate water and utilize it efficiently to optimize benefits and conserve the environment. Policy objectives of reforms differ greatly (Vermillion and Sagardoy, 1999), and thus achieve varying outcomes. In addition, while considerable preparatory

1- Head, IWMI Office for West Africa. Accra, Ghana. E-mail: m.hassan@cgiar.org
2- Head, IWMI Office for Iran. C/o Iranian Agricultural Engineering Research Institute (IAERI), P.O. Box. 31585-845, Karaj, Iran. E-mail: a.sarwar@cgiar.org
3- Senior Researcher and Member of Scientific Board. Iranian Agricultural Engineering Research Institute (IAERI), P.O. Box. 31585-845, Karaj, Iran. E-mail: nrheydari@yahoo.com

inputs are usually provided to prepare policies and legal frameworks, a necessary but not sufficient condition for achieving the desired objectives (Prathapar et.al., 2001; Molle, et. al., 2004), the enforcement mechanisms generally receive less attention. Water reforms, if not conceived and implemented well, can lead to further deterioration of the situation rather than improving it (Kendy, et. al. 2003) and often might actually hit the poor hardest (van Koppen, et. al, 2002). Iran, an extremely water scarce country, in its intent to search for solutions for optimizing the use of water resources, intends to devolve water management to local level institutions, and some efforts have been piloted.

Iran is one of the most water scarce countries and faces the multiple challenges of a rapidly growing population, limited freshwater availability and over-exploitation of groundwater. In this context, the Iranian government has embarked upon various policies aimed at improving the productivity of land and water resources. One of such policies is devolving the responsibility and authority of irrigation management to users through irrigation management transfers. This paper documents the outcomes of the establishment of Water Users Associations (WUAs) in Iran, and the issues around these reforms, and proposes a framework based on the lessons learned from Iran and elsewhere in Asia.

This paper describes the context in which IMT is taking place in Iran. It reviews the existing operation of IMT in two pilot areas i.e. Karmanshah and Qazvin. The paper also discusses the lessons learned in IMT n other parts o the world and finally propose an IMT Framework for Iran.

IRANIAN CONTEXT

Iran, one of the oldest civilizations of the world, is situated in the Middle-East region of the South-Western Asia and is located between 25^o and 40^{o}N and 44^o and 63^{o}E. The national territory covers a total land area of about 1.65 million Km^2. Iran is the most populous country of the region, and the 16th most populous in the world. The total population is about 67.3 million (1995)[1], of which 41% is rural. The population living in urban areas has increased by 14% during the last three decades. Currently, 61% people are living in urban areas as compared to only 47% in 1976 (Shiatti, 1999). This fast urbanization has increased the domestic and industrial demand for water, which has put enormous pressure on the agriculture sector to reduce its consumption of water and increase the productivity of available water resources. In order to sustain agriculture, serious efforts are needed to generate economic activity in the rural areas to restrict migration of rural population to cities.

Although climatic conditions of Iran are typically of an arid and semi-arid region, it enjoys a wide spectrum of hydrological conditions. Annual rainfall ranges from less than 50 mm in the deserts to more than 1600 mm on the Caspian Plain. The average annual rainfall is 252 mm and approximately 90% of the country is arid or semiarid. Overall, about two-thirds of the country receives less than 250 mm of rainfall per year.

1- According to the other literature, the population is 60 million based on 1996 statistics, of which 38% lives in rural areas. The average population density is also reported as 36 inhabitants per km^2 (Shiati, 1999). The average rate of population growth is reported as 3.91% during 1976-86, 2.46% over a period of 1986-91 and only 1.47% from 1991-96.

Agriculture accounts for about 25% of the country's GNP and employs about 27% of the work force. Over the recent years, the agriculture sector has achieved a growth rate of 5% with some fluctuations mainly due to changing climatic conditions. A high proportion of farms are considered small in size. About 70 % of the landholders possess less than 5.5 ha (of which on average 2.13 ha irrigated and 3.25 ha rain-fed). These are generally subsistence farmers with no surplus products for sale. Their farm incomes are low because landowners exploit the labor of sharecroppers to earn more profit. Women constitute a large proportion of the agricultural labor force. Rural women play a very important role in animal husbandry. Women do more than 86% of the milking, and 42% of the feeding, watering and health care of animals. Women also carry out 90% of the milk processing, both for home consumption and for sale.

During the past two decades, Iran continues to experience a slow transition from a traditional rural-based society to a semi-industrialized society. This has brought many challenges for the local people that include high unemployment rate (presently estimated to be above 25%), distorted distribution of income and inequity in opportunities for growth. Although official figure for poverty in Iran is set at 18% of the population, more than 16 million people (about 25%) are estimated to be living under the poverty line.

WATER RESOURCES AND IRRIGATION MANAGEMENT

Internal renewable water resources of Iran are estimated to be 130 km^3/year. Surface runoff amounts to 97.3 km/year, of which 5.4 km^3/year comes from drainage from aquifers (spring flows), and groundwater recharge is estimated at about 49.3 km^3/year, of which 12.7 km^3/year is obtained from infiltration through river beds.

According to 1998 estimates, the total water consumption is approximately 88.5 km^3, out of which more than 93 percent is used for agriculture while less than seven percent is allocated for domestic and industrial uses (Kehsaverz et al, 2003). The use of groundwater for irrigation purposes is much higher in Iran as compared to many other countries of the world (Table 1). Presently, more than 50% of the water available at the farm gate comes from the groundwater. The current estimated annual groundwater abstraction is about 55 BCM compared to annual recharge of only 46 BCM. Due to this 9 BCM annual overdraft, groundwater tables are declining in many areas. Pumped groundwater is used for irrigation both in isolation and in conjunction with the surface water, which is creating serious salinity threats in the irrigated areas.

Despite the shortage of water, the over-use of water in irrigation is a major problem in Iran. At present, a big gap exists between water delivery from main canals and water application in the field. The overall efficiency of irrigation systems ranges from 33% to 37% (Keshaverz, et al., 2003). In practical terms, therefore, much surface water is lost enroute, which, if salvaged, could be profitably used to bring more areas under irrigation.

INSTITUTIONS FOR WATER MANAGEMENT

Until the early 1990's, water management for agriculture at the local level was part of communal responsibilities. The communities diverted the canal flows to earthen secondary and tertiary canals, and the silt clearance and strengthening the embankments were the only water management activities that were collaboratively performed through village organizational structures. These communal organizations were responsible for not only water management but also for other communal activities such as weddings, funerals, religious ceremonies, education, etc. Decision making was undertaken in communal meetings that were chaired by the village elders and attended by heads of households. Water distribution was done according to the equity concept perceived by the community members, and water was distributed in rotational turns. The main canal was perceived to be government's property and responsibility.

Table 1. Groundwater use for irrigation in selected countries.

Country	Irrigated area (million ha)	Irrigation use (km^3/year)	Proportion of groundwater (%)
India	50.1	460	53
China	48.0	408	18
Pakistan	14.3	151	34
Iran	**7.3**	**64**	**50**
Mexico	5.4	61	27
Bangladesh	3.8	13	69
Argentina	1.6	19	25
Morocco	1.1	10	31

Source: (Qureshi, 2004)

In the 3rd Five Year Development Program (FYDP: 2000-2004), the government recognizes that the potential for water resources development in Iran is very limited and therefore more emphasis should be given to conserve water at all levels. The government, thus, encourages the promotion and creation of Water Users Associations (WUAs) to devolve irrigation system management responsibility and authority at the local level, whereby the traditional local authorities would be able to coordinate water management within their community and be part of the WUA at the (sub)system level. As a result, the process of creating WUAs along all tertiary canals and federating them up to the main canals for irrigation system management has started.

Apart from the informal collective action at the community level described above, a number of formal institutional structures exist, which are responsible for collective action at the village level. These include Village Islamic Council,Rural Cooperative Organizations (RCOs) and Rural Production Cooperatives[1] (RPCs), Well Cooperatives and Water user Associations (WUAs).

1- A cooperative can be a small group of people with a minimum membership of 7 people. There is no limitation of maximum membership. A cooperative normally comprise of 3 to 5 board members (managing director, deputy director, secretary and members). The cooperatives can be established for all sectors. In Iran, the cooperatives established for the agricultural sector involve agriculture (both green house and field crops), animal husbandry, agro-industry (shoe making, carpet making etc), processing and facilities and operation and maintenance of irrigation infra-structure.

IMT IN IRAN: EXPERIENCE FROM TWO IRRIGATION SYSTEMS

For the limited scope of this study, the experience of WUAs in two different basins is reviewed below. The WUA in Kermanshah Province (Gharasu tributary located in the upper reach of the Karkheh Basin, and organized along the territorial principles of villages) was studied by PCI (PCI , 2004) and the one in the Qazvin Province (Qazvin Pilot Project) organized along hydrologic boundaries of Qazvin canal) was visited by the authors together with a study team from Bureau of Extension of the MoJA (Figure 1). The irrigation systems in Kermanshah Province are under rehabilitation, while those in the Qazvin province were rehabilitated some 20 years ago. The key findings of these assessments are given in the following section.

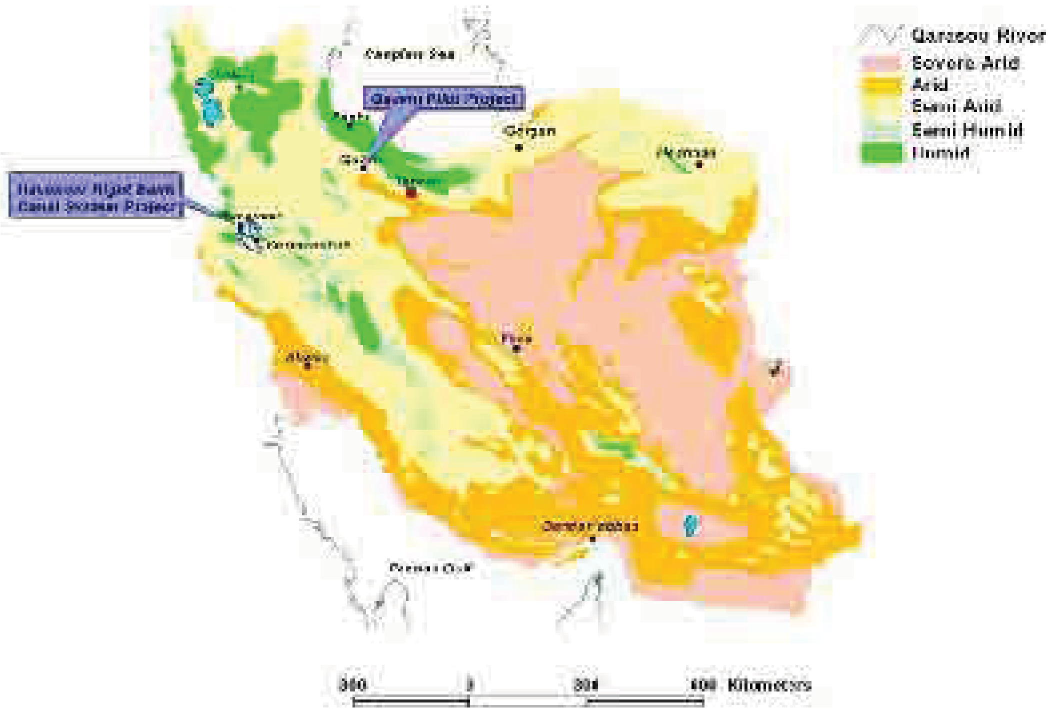


Figure 1. Map of Iran showing locations of two pilot projects studied.

RAVANSAR RIGHT BANK CANAL IRRIGATION SYSTEM IN KERMANSHAH PROVINCE[1]

The study area is located in the center of *Sanjabi* plain, which is surrounded by mountains and has mountain climatic conditions. The rainfall at Ravansar is about 527 mm of which 90% occurs in November to April (PCI, 2004). The water resources used for irrigation are derived from surface sources, springs and groundwater. However, the main source is the *Gharasu* River, especially during the dry season. Additionally, the two seasonal rivers, *Gharab* and *Kilanba*r rivers only provide water during rainy season. The *Gharasu* river receives an important part of its flow during the dry season from the

1- The information presented in this section is extracted from a recent JICA Study reported by (PCI, 2004).

Ravansar Spring, along with *Jaberi*, *Ghar Daneh* and *Mir Azizi* Springs. There are 352 registered wells in the Ravansar command area and the amount of approved groundwater extraction is 45.24 MCM sufficient for about 5000 ha.

Most of the irrigation systems are multipurpose in nature and serve irrigation, flood control, improving inundation and groundwater recharge purposes. Average land holdings are generally smaller than 5ha, and due to absentee landlordism, a number of holding are cultivated through sharecropping arrangements causing fragmentation of operational holdings. The Ravansar Irrigation system comprised Ravansar Right Bank Canal with a 700 ha command area and Ravansar Left Bank Canal with a command area of 2000 ha. In addition, some 175 pump owners had been allowed to extract water directly from the river to irrigate about 1000 ha. Some 20 un-licensed pumps were also operating in 2003 (PCI, 2004: 3-34). The operation of the Ravansar diversion gates are carried out by the Ravansar Water Affairs Office (RWAO), while the on-farm activities are done by the provincial branch of agricultural ministry.

The water users of secondary canals are more or less the same farmers, whose lands might be located along several watercourses. Two IMT models had been tried out. In 2000, O&M of the irrigation system was initially transferred to a semi-government company (Western Regional Water Utilization and Delivery Service Company-WRWUDSC) for water fee collection and O&M of the canal. Later, in 2003, a Water Users Cooperative Company (WUCC) was formed and the following organizational structure in was imposed with the MoC responsible for establishing the WUA (Figure 2).

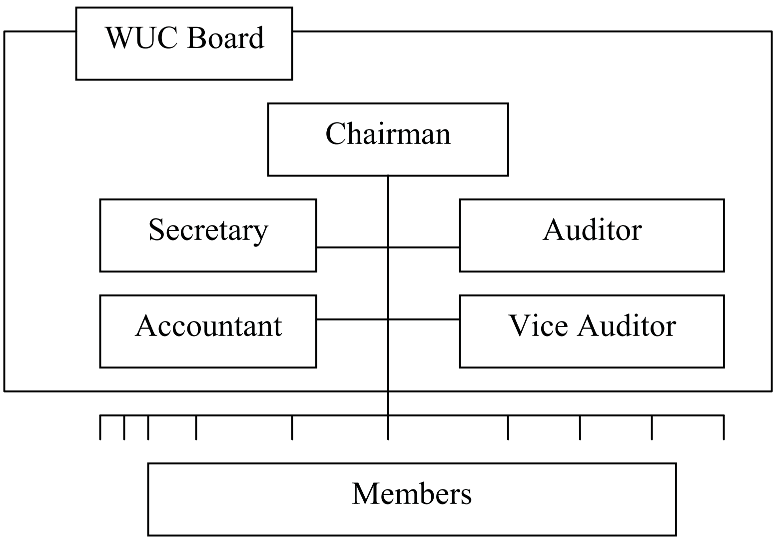


Figure 2: Organizational Structure of Water Users Cooperative for the Ravansar Right Bank Canal

The rights and responsibilities of the WUAs were largely perceived as the O&M contractors to the MoE, rather than independent local organizations managing water on behalf of the water users. WUAs in the Ravansar irrigation system were not clear about the respective roles of MoE as "water supplier" and MoJA as responsible for provision of advice on crops. Thus, the farmers remained uncertain about where to go for the solution of their problems. Due to lack of clarity about the objective of WUAs amongst the local government staff, the central government's intentions of improving water management through the participation of local farmers has not been properly communicated. As a result, true participation of farmers has not happened to support successful WUAs. Another reason of farmers' lack of cooperation is the lack of reliable water supply by MoE. Therefore before involving farmers in water management, the MoE needs to ensure reliable water supply in the canal systems, so that the users have enough incentives to participate in their WUAs.

IRRIGATION SYSTEMS IN THE QAZVIN PROVINCE

In Qazain province, IMTs were planned in 2002 after consultations between MoE, BoE and MoC. In Qazvin, 860 kilometers of tertiary canals were transferred in 2003, 250 kilometers of secondary canals in 2004 and 94 kilometers of main canal in 2005. In total some 158 WUAs have been formed so far in Qazvin province alone. During the WUA formation, all stakeholders were consulted in brief meetings. According to the head of Water Management Company, the groundwater forms a significant proportion (50% or more) of water resources available and used for agriculture. Though agriculture is the main water user, the surface water systems also serve municipal and environmental uses.

The WUAs are mandated to either manage surface or groundwater, and the conjunctive management is currently not a WUA responsibility. The older canal systems are in serious need of rehabilitation and maintenance. The main and secondary canals are equipped with hydraulic gates. The canals are operated only for 12 hours per day, and only in summer time (April-October). The system of water supply has been a demand based one - each farmer needing water has to submit his demand, get a pay slip either from WUA or from WMC if WUA is not operational, pay the charge in advance at the bank, and return payment receipt to canal office, which will then issue a water release slip specifying time, date, discharge and duration of water supply. This on-demand system was quite sophisticated, but had a lot of transaction costs for farmers. Both WMC and the WUAs have been operating the irrigation systems using this design approach, with one key difference of local water ordering system pursued by WUAs versus centralized order system followed by WMC.

Before the emergence of WUAs, the main issue farmers faced were related to the time and effort each farmer had to spend in traveling to submit his demand almost once every ten days during the cropping season, and paying the charges and then again providing the proof of payment for water release. Thus, the **main incentive** why farmers supported the management transfer was that many of them could reduce transaction costs by saving on the time and effort they would otherwise spend in ordering water, as through WUAs, ordering water and paying for it was to be localized. The creation of WUAs has thus enabled farmers to use a more grass-roots oriented system of locally ordering water than a cumbersome and centralized one.

The fee collection rates were low initially, but the FUWUA had taken steps and issued sanctions, and now the collection of Irrigation Service Fee (ISF) is almost 100%, which is deposited to Ministry of Energy, which is supposed to return 25%[1] of collection to FUWUA for Operation and Maintenance costs. The key constraints include lack of start-up capital, availability of credit for maintenance, lack of coordination between MoJA, MoC and MoE, as well as within different branches of Ministry of Energy. Overall, the farmers still have complaints about WUAs regarding the quality of service and the maintenance of infrastructure. The WUAs have received quite old and dilapidated canals, some parts of which are in serious need of rehabilitation.

Rehabilitation and maintenance costs are rather high due to lined channels, as the system receives a high load of stones which require mechanized cleaning annually. These costs are high due to financial difficulties faced by the FUWUA due to non-provision of their share in the ISF. According to farmers, the reasons for delayed or non-payment of WUA share of ISF were largely due to poor coordination between various branches of MoE.

SECOND GENERATION PROBLEMS IN EARLY IMT PROGRAMS[2]

Insecure water rights were reported to be the frequent most second-generation problems affecting WUAs in Philippines, Turkey, Mexico, Colombia and Argentina. So were the financial shortfalls, lack of rehabilitation and lack of capacity amongst WUAs for effective financial and administrative management. Though most farmers have managed their water for many years at their fields, they lack knowledge and experience of managing systems. While taking on new roles of governance, they need basic knowledge across several disciplines in order to keep their hired staff accountable. Thus, there is a need for capacity-building and support services mechanism for reliable legal and technical advice. Also, there is a need for either a support service for lobbying in governmental policy forums, or apex level WUA bodies that can present and argue for WUA rights at higher policy forums.

Most WUAs have faced **financial shortfalls** for various reasons. As reported by Vermillion (1997), the WUA managements tend to charge less from their members, and adopted several corollary cost-cutting measures in order to be popular. This has resulted in ignoring necessary maintenance and repair work. Several reasons contribute to low fee setting and poor recovery; including lack of authority to set fees and apply appropriate collection measures (Pakistan); lack of metering devices to charge by volume (Tajikistan, Uzbekistan and Kyrgyzstan), where the state policy is to charge by

---

1- It is not clear how the shares of government and FUWUA were defined in Service Fee. The ideal principle for fixing the ISF in Iranian conditions would be to allocate all operation and maintenance costs PLUS a discounted amount of infrastructure replacement costs. The system being described here originates from a river, and thus the FUWUA should only be paying the infrastructure replacement cost to the government while keeping the balance for meeting its operation and maintenance and rehabilitation costs. It is thus proposed to conduct a detailed investigation on this to help policy makers develop a transparent ISF charging system. In addition, how the charges are to be levied and collected from farmers, should be internal FUWUA business, which is largely dependant upon its infrastructure. For example in the system visited, charges are levied volumetrically, but if the water volume upstream varies, the theoretical discharges are not guaranteed. Thus a farmer might end up paying for less or more water than planned and received. (This is not a proper volumetric system if it relies on correct operation to deliver a nominal rather than an actual volume)

2- This section is based upon the findings of Svendsen, et. al., (2000).

volume; not keeping promises on provision of subsidies from the state (Uzbekistan); and lack of conformance to agreements by state bodies; and farmers' ability to pay (Sri Lanka, Nepal, Iran, and Central Asia).

Most IMT programs tend to turnover systems that are in serious need of rehabilitation, and the IMTs are attached to the donor conditionality rather than an internally felt need. Besides, the maintenance needs of such systems are not carefully assessed and diagnosed. Some South East Asian countries like Vietnam, Indonesia, Thailand, and to an extent the Philippines, have made an industry out of rehabilitation for IMT. The Ravansar case in Iran exhibits as if Iran is also embarking on the same path.While the WUAs take over the management due to state in-efficiency, many systems are not easy to operate and maintain due to technology or seriously and continuously deferred maintenance. In many other systems, the system designs might be outdated to cater to more recent needs. Even in systems that are attached to a donor-funded maintenance and rehabilitation program, WUAs lack capacity to prepare proposals and mobilize co-financing. WUAs do not find enough incentives not to defer maintenance.

Lack of financial and administrative management expertise amongst users often becomes a major problem. While farmers do manage resources and staff individually for their farming, they have relatively less experience in doing so in an organized fashion. In many instances, the WUA management could take decisions that are contradictory to their set policies or objectives. In many WUAs, lack of will to apply sanctions has resulted into poor resource mobilization for maintenance. In addition, identifying and recruiting appropriate staff becomes a major headache in many countries like Central Asia, where irrigation system management is a rather unique expertise available to state employees only, and the experts and staff WUAs get had never worked with private organizations.

Irrigation agencies face problems of dislocation/shortfall of staff, erosion of technical capacity and need to define and assimilate the new role for the agency in the changing context. Besides, in many water scarce countries, there is a lack of will on part of the state agencies to step away from rent seeking (as explained earlier for Indian case) which can frustrate the IMT efforts.

Farmers generally face challenges of increased water fees, additional physical participation in O&M, and additional transaction costs of acquiring and using information. In addition, they have also to bear the additional burden of adjusting to the new institutions.

PROPOSED IMT FRAMEWORK FOR IRAN

Iran has already identified IMT as a policy for future water resources development and management, and is encouraging transfer of irrigation systems to local level organizations. The objectives of such efforts remain vaguely defined in terms of efficient water resources management, improved farm income and reduce government spending. Most of these objectives can not be achieved simultaneously and need compromise. The objectives might also vary for different levels of an irrigation system. Thus, there is a need to clearly set policy objectives, and define a clear strategy for how to design, implement, and monitor IMT in various river basins and agro-ecological settings to meet those objectives. An IMT strategy should clearly spell out the roles and responsibilities of MoE, BoE, and MoC in relation to the new organizations emerging for water management, and the IMT should be piloted in a few selected canal commands and then out-scaled to larger areas. The mandate of the current collaborative committee of the three ministries can be expanded to formulate such a strategy, and make arrangements for its implementation, monitoring and periodic review.

The most recently introduced legislation on irrigation improvements might bring more investments, but could lead to greater inequality amongst water users and put the access to water by poor people in jeopardy. In addition, WUAs are currently organized under cooperative law, which applies to business cooperatives. WUAs manage a common pool resource in the public interest and thus are not strictly business cooperatives. A serious review of all applicable laws to agricultural water management, including laws related to land rights, is essential to remove inconsistencies amongst various laws. Many countries have resolved for special laws relating to IMTs that over-ride the existing laws wherever there is a conflict. This might be path for Iran to follow.

The experience of devolving management to companies in Kermanshah instead of WUAs has already proved that such arrangements are neither efficient nor sustainable. Thus, commercialization of irrigation management does not seem working in Iranian context. On the other hand, the experience in the Qazvain province of establishing tiered users organizations seems quite successful, despite several constraints faced by the WUAs. Collective action for water management has a long history in Iran, where tribes and communities have been self managing qanat systems since centuries. Thus, mobilizing farmers to form tiered WUAs with government moving its role to facilitation and regulation could lead to viable WUAs.

The organizational model of WUAs followed in Qazvin province, with some modifications might be adopted and tested out. For example, the watercourse level WUAs might be too small to be financially and technically viable. Instead, informal water user groups could be organized along quaternary and tertiary canals along the same lines as in Qazvin for preparing cropping plans and assessing water demand, as well as distributing water amongst their group members, undertaking maintenance and conflict resolution at the local level. The formal WUAs at the secondary canals level might be more suitable. The Secondary canal WUAs can then be federated at the main canals and take O&M responsibility for the entire system (See Figure 3 for Illustration). The qanat systems have complex and detailed operational rules and procedures, detailed memberships, rights, obligations and often hereditary water masters. Such systems need to be understood well before any careful intervention aimed at enhancing the operational performance.

One cautionary point relates to the clarity in land and water rights. As there are growing trends of sharecropping, absentee landlordism, and land fragmentation, it is important that the mobilization models ensure inclusion of smallholders and leaseholders in the WUA formation processes. A good practice is to allocate leadership quotas for various landholding categories, with majority to the smallholders and farmers from the tail-ends of canals.

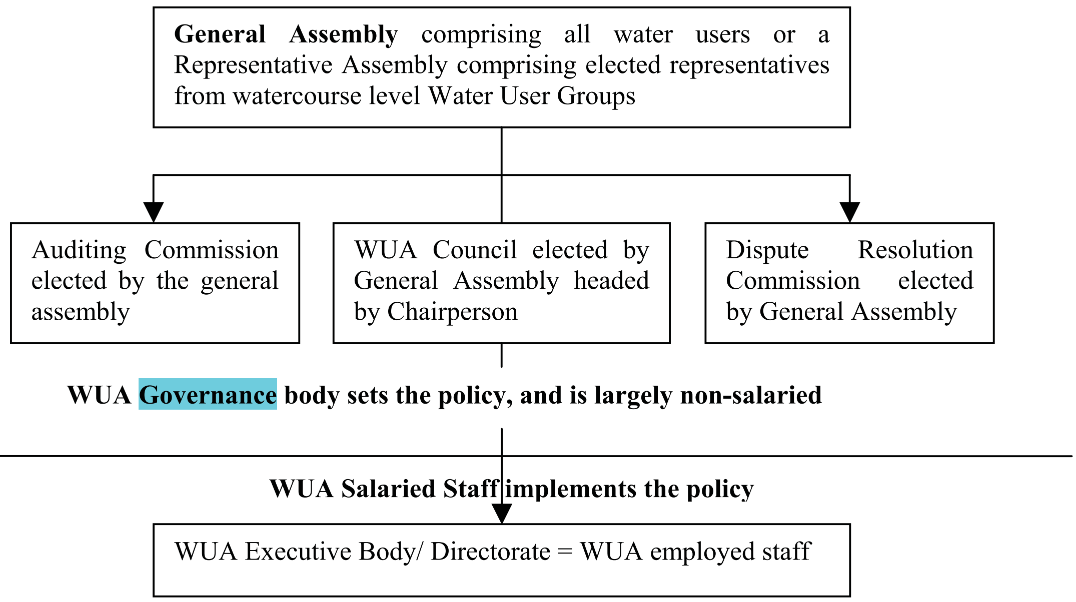


Figure 3: Organs of a Water User Association (adapted from Ul Hassan, 2004.

At the pilot sites, it appears that governance and management has been fused together. Governance bodies are farmer representatives elected out of farmers for WUA level policy formulation and implementation oversight. These positions are generally not paid salaries or commissions, but when they spend time on WUA supervision, etc. their time and other costs are then compensated through payment of daily allowance, travel costs, accommodation, etc. The management (staff) positions are fully or partially paid, but they should not have the right to represent water users. It is important to keep management and governance separate (See appendices I and II for Illustration). When they are not separate, there is a chance to induce corruption in the organization.

Setting and collecting the water charges appropriately is an important issue for Iran. Presently, water charges are set at 3% of the gross farm incomes. However, considering the differences in water resource availability and agro-ecological zoning, the infrastructure for irrigated agriculture might be more expensive in some areas than in others, due to, for example, differences in water source, irrigation technology, etc. In such situations, the present rule of thumb will make O&M financing extremely unreliable. In most countries, water for agricultural use has no price as a resource. What farmers pay is generally the cost of water delivery services, including operation, maintenance, and governance costs, and occasionally infrastructure replacement costs. The most transparent way of doing it is to establish these costs for the irrigation system managed by WUAs, and adding proportionate costs for upstream system (main canals, diversion system, etc.). The reservoir operation and maintenance costs are generally not charged to farmers, but are recovered from other sectors and uses (municipal, environmental and power). Since the water charging policy of Iran is unclear, it is proposed that such a study be commissioned as early as possible, and the water pricing policies be then adjusted based on the recommendations of the study. In addition, the fee charging mechanisms within the WUAs should be left to WUAs and not imposed from above. The current practice of charging a fixed proportion of agricultural income as a water fee is neither transparent, nor efficient in encouraging water conservation.

The arrangement for resolving water-related conflicts between WUA members, amongst WUA members and WUAs, among WUAs and the water service provider are not clearly defined, and need to be identified. For example, the disputes within an organizational tier could be resolved internally, and in case there are disagreements, the affected party could appeal at the next higher tier. The disputes between the WUAs and the state agencies might be resolved by independent courts or arbitration commissions.

Transparency and accountability are two key pillars of participation. The situation with regard to overall water rights for FUWUA in Qazvain is not clear. Likewise, as was explained by farmers, while FUWUA is fully accountable to state (depositing ISF to state fully), the state is not accountable to FUWUA (untimely water release, non provision of ISF share of FUWUA). These issues need to be resolved through the IMT agreement to be signed by the FUWUA and the water service provider.

The ultimate objective of handing over the management of irrigation water to farmers is to introduce efficiency, discipline, and conservation for enhancing water productivity. However, as was the case in Qazvin, the pioneering WUAs are facing problems due to state agencies. While the WUAs might be able to meet the challenge in the short run, continued dis-incentives might affect negatively on their ambitions and enthusiasm. Thus, it is of paramount importance that the incentive structures and policies are set in a way that encourage water users and their associations, as well as the other water managing entities to manage it better. For example, soft loans or small matching grants for maintenance might encourage WUAs to improve maintenance, and thus reduce conveyance losses. Similar loans for water application technology might help water users to reduce consumption.

CONCLUSIONS

Implementation of IMT in Iran is relatively new. Therefore, there is a clear need for institutionalized arrangements for social mobilization and capacity-building, as well as strategies to achieve higher awareness and participation in both organizational development as well as organizational action. A social mobilization and capacity building action program might be needed. In the capacity-building programs, it needs to be ensured that the capacity building efforts take care of needs of the future organizational leaders as well as the current leaders. While MoC has the mandate to organize agricultural cooperatives, water management is a much more specialized task. The BoE and MoC should pool their resources and come up with a WUA mobilization and capacity-building strategy and a pool of WUA mobilizers and trainers. This pool can latter provide backstopping and support services to WUAs. A more rigorous and well structured social mobilization approach would help speed up organizational building. Such an approach comprises of identifying and deputing Social Mobilizers from provincial extension staff, training them in social mobilization and capacity-building of WUAs, and then starting the social mobilization process simultaneously at several locations. The mobilization process needs to be carefully designed and implemented with a rigorous and robust monitoring component to regularly advise on the needed changes in content, design and strategies.

REFERENCES

1. Kendy, E.; Molden, D. J.; Steenhuis, T. S.; Liu, C.M.; Wang, J. 2003. *Policies drain the North China Plain: Agricultural policy and groundwater depletion in Luancheng County, 1949-2000*. Research Report 71. Colombo, Sri Lanka: International Water Management Institute.
2. Keshavarz, A., Heydari, N., Ashrafi, S., 2003. "Management of agricultural water consumption, drought, and supply of water for future demand" (2003), 7th Int'l Conference on Sustainable Development and Management of Dry-lands in 21 century, Tehran, Iran, 4-17 Sep. 2003.
3. Marjanizadeh, S., Qureshi, A.S., Ahmad, M. D., 2007 (forthcoming). Historical Transformation and Evolution of the Karkheh River Basin (1900-2025). IWMI Research Report??. International Water Manegement Institute (IWMI), Colombo, Sri Lanka.
4. Molden, David; Boss, M.G. 2005. Improving basin water use in linked agricultural, ecological and urban systems: Seeking new flow paths and avoiding dead ends. Water Science & Technology, 51(8): 147-154
5. Molle, F., Mamanpoush, A, and Miranzadeh, M. 2004. Robbing Yadullah's water to irrigate Saeid's garden: Hydrology and water rights in a village of central Iran. Research Report 80. Colombo, Sri Lanka: International Water Management Institute.
6. PCI (Pacific Consultants International). 2004. The study on Gharasu River Basin Agriculture Development Project: Kermanshah Province in the Islamic Republic of Iran. Final Report. Japan International Cooperation Agency and Ministry of Jihad-e-Agriculture of Iran., Tehran.
7. Prathapar, S. A., Ul Hassan, M., Mirza, Z. I. Tahir, Z. 2001. Constraints on enforcement of water policies: Selected cases from South Asia *In Brennan, D. (Ed.), Water policy reform: Lessons from Asia and Australia – Proceedings of an International Workshop held in Bangkok, Thailand, 8-9 June 2001. pp 171-176. Canberra, Australia: Australian Council for International Agricultural Research.*
8. Qureshi, A.S., 2004. Development of IWMI-AREO collaborative research program to improve land and water management in Iran. Discussion paper. Paper presented at the joint IWMI-AREO workshop held in Karaj, Iran, 22-23 September 2004.
9. Shiatti, K., 1999. World Water Vision for Food: Country Case Study, Iran. Paper presented at the Middle east and North Africa (MENA) consultative committee, Italy.
10. Svendsen, M., Trava, J. and S. H. Johnson III. 2000. A synthesis of benefits and second-generation problems. In Groenfeldt, D., and M. Svendsen (eds). 2000. Case Studies in Participatory Irrigation Management. World Bank Learning Resources Series. World Bank. Washington DC. United States of America.
11. Ul-Hassan, M. 2004. Constraint to IWRM Implementation with special reference to Water Users Associations. A paper presented at the Scientific and practical seminar titled "Deepening reforms in and perfecting of legal base of water management in Uzbekistan" in Tashkent on November 25, 2004, organized by the Agriculture and Water Committee of Oliy Majlis (parliament) of Uzbekistan.
12. van Koppen, B; R. Parthasarathy; and C. Safilion. 2002. Poverty Dimentions of Irrigation Management Transfer in Large Scale Canal Irrigation in Andhra Pradesh and Gujarat, India. Research Report 61. Colombo, Sri Lanka: International Water Management Institute.
13. Vermillion, D. 1997. Impacts of Irrigation Management Transfers: A review of evidence. Research Report 11. Colombo, Sri Lanka: International Water Management Institute.

APPENDIX I: Proposed Governance and Management Functions in an Iranian WUA:

WUA Governance	WUA Management
1. Approval of WUA status and by-laws 2. Approval of membership and new members 3. Election and appointment of executive bodies including leaders 4. Approval of rules and fees for water services 5.Approval of plan for water distribution and its control 6. Approval of budget 7. Addressing WUA development questions 8. Monitor the performance of WUA management by selecting performance and service delivery standards 9. Approval of audit 10. Dispute resolution	1. Preparation and finalizing of seasonal water requirement and distribution plan 2. Fair water provision to all water users 3. O&M of infrastructure 4. Environmental Protection Plans 5. Organization of water accounting 6. Data collection and database management 7. Assisting WUA to improve financial potential 8. Organization of financial and audits 9. Assistance to farmers to increase water productivity and conservation

Source: Adapted from Ul-Hassan, 2004.

The day to day functions of a WUA include:

a) Distribution of water, according to agreed schedule and prevailing water rights/allocation

b) Operation of hydraulic infrastructure – head gate, regulating structures and farm turnouts (unless the farmer does this)

c) resolution of disputes over distribution and allocation

d) setting and agreeing the level of water fees

e) assessment and collection of fees

f) Book keeping for costs and income to the WUA and presentation of accounts in public meetings, at least once per year; record keeping and keeping of a bank account.

g) Optionally, the provision of input and marketing services for specified items.

h) Organization and payment for maintenance of channels, structures, and public access (roads, bridges, tracks etc); ditto for any costs involving pumping, fuel, etc

i) Organization and payment for up-grading (modernization or improvement) of the system, to better meet farmers' operational needs.

j) Monitoring of canal and drain flows, rainfall and groundwater use.

APPENDIX II: A Schematic Diagram of Hydraulic Infrastructure and Proposed Management Organization

Hydraulic Level	**Organization**	**Key Functions**
River Basin	Basin Authority	Make basin policy & regulations, collect and process hydro-meteorological information, prepare sectoral water allocation, conservation, asset management & development, & financial plans, make inter-organizational agreements, regulate FWUAs, settle disputes amongst FWUAs
Primary/ Main Canal	Federation of WUAs supply	Collect, provide & analyze water
		data to support transparent management, prepare & implement water allocation, conservation, drainage,
	asset	management & development, & financial plans, manage surface and groundwater conjunctively, regulate WUAs, settle disputes
Distributory Canals	Water User Association	Collect, & analyze water supply data, prepare & implement water allocation, delivery, conservation, drainage, asset management & development, & financial plans, settle disputes amongst WUGs, apply sanctions on offenders, Assesss and collect water fees
Watercourse Canals	(informal) Water User Groups:	Distribute water, assess and implement maintenance, resolve disputes within members, report offenders, apply sanctions

= *Regulation/coordination*

= *Provision of services*

= *Negotiation & agreements*

= *Payment for services*

SUSTAINABLE WATER MANAGEMENT IN THE DAKAR AGRICULTURAL BOTTOM-LANDS.

Dr Sylvestre Dasylva[1]*, Dr Claude Cosandey[1]

ABSTRACT

In Sub-Saharan region of Africa, the rainfall amount decrease has dramatic consequences on the hydric resources. The today annual precipitation does not permit any "efficient" recharge of groundwaters. That is the case in the Dakar agricultural bottom-lands which are depressions located in the sand dunes. The main characteristic of these lands is that the top-table quaternary sand groundwater (Nappe des Sables Quaternaires or NSQ) reaches or overflows the soil surface. Thereby, agricultural activities are based on irrigation using generally traditional farming practices; production supplying Dakar city in fruits and vegetables. Because of recent climatic crisis, the groundwater depletion threatens the agricultural activity on the long time.

Concerning strategies used to solve the surface water problems, some management practices existing in the African cities are matter of debate, more precisely in Sahalian zones. For example in the case of Dakar, rainwater management techniques are diverting waters toward the sea or evaporation basins. In a rainfall scarcity context, and with the possibility of storing drained waters in the sand dunes and reusing them for irrigation, this strategy leads to a loss of resource. This study aims to promote an innovating approach and technical measurements for increasing rainwater infiltrating volume feeding the NSQ groundwater, in order to reduce losses and enhance water availability. These measurements would allow to mitigate the current climate crisis and urbanization related constraints. This strategy is supported by the following hydrodynamic indicators 1/ the groundwater static level annual balance and 2/ the rainwater infiltrating rate variabilities. These parameters are calculated according to three pluviometric models -average, low and excess rainfall- representing the 80 last years rainfall variability.

INTRODUCTION

The site of this study, Dakar area, is located in the western central part of Senegal (figure 1a), between 17° 33' / 17° 05' West and 14° 55' / 14° 35 North coordinates. Climate is sahalian and pluviometric average is around 500mm. The term "niayes" is the local designation of the agricultural bottom-lands. These lands are depressions located in the sand dunes system where the top-table of quaternary sand groundwater

1- C.N.R.S. / Laboratoire de Géographie Physique Pierre Birot - U.M.R. 8591, Univ. Paris 1
*1- place A. Briand 92195 Meudon Cedex; Gilbert.Dasylva@cnrs-bellevue.fr;
Tel.: 01 45 07 55 77; Fax: 01 45 07 58 30

(Nappe des Sables Quaternaires or NSQ) reaches or overflows the soil surface. These wetlands occupy a large surface in the area (figure 1a-1b). They are often exploited by traditional farming practices using irrigation, the production supplying the city of Dakar in fruits and vegetables. Farms in the “niayes” are specialized in market vegetable gardening [cabbages, carrots, salads, onions and tomatoes (figure 1c)], and fruit production [mainly mangos, papaws, oranges, mandarins (figure 1d)]. Urban and peri-urban agriculture has been on the rise and is now estimated to provide 60% -some 39.000 tons annually- of Dakar’s consumption of vegetables.

Nowadays, the bottom-lands groundwater depletion, related to rainfall insufficiency, causes more and more constraints on irrigation and threatens traditional agriculture on the long time. The ecosystem of the “niayes” are relicts formed during quaternary wet climate, and it is in dephasing with the current pluviometric conditions, their preservation is an important issue in the region. The goal of this paper is to propose, in an urban and peri-urban context, an innovating approach and technical measurements enhancing groundwater availability in order to mitigate related water problems.

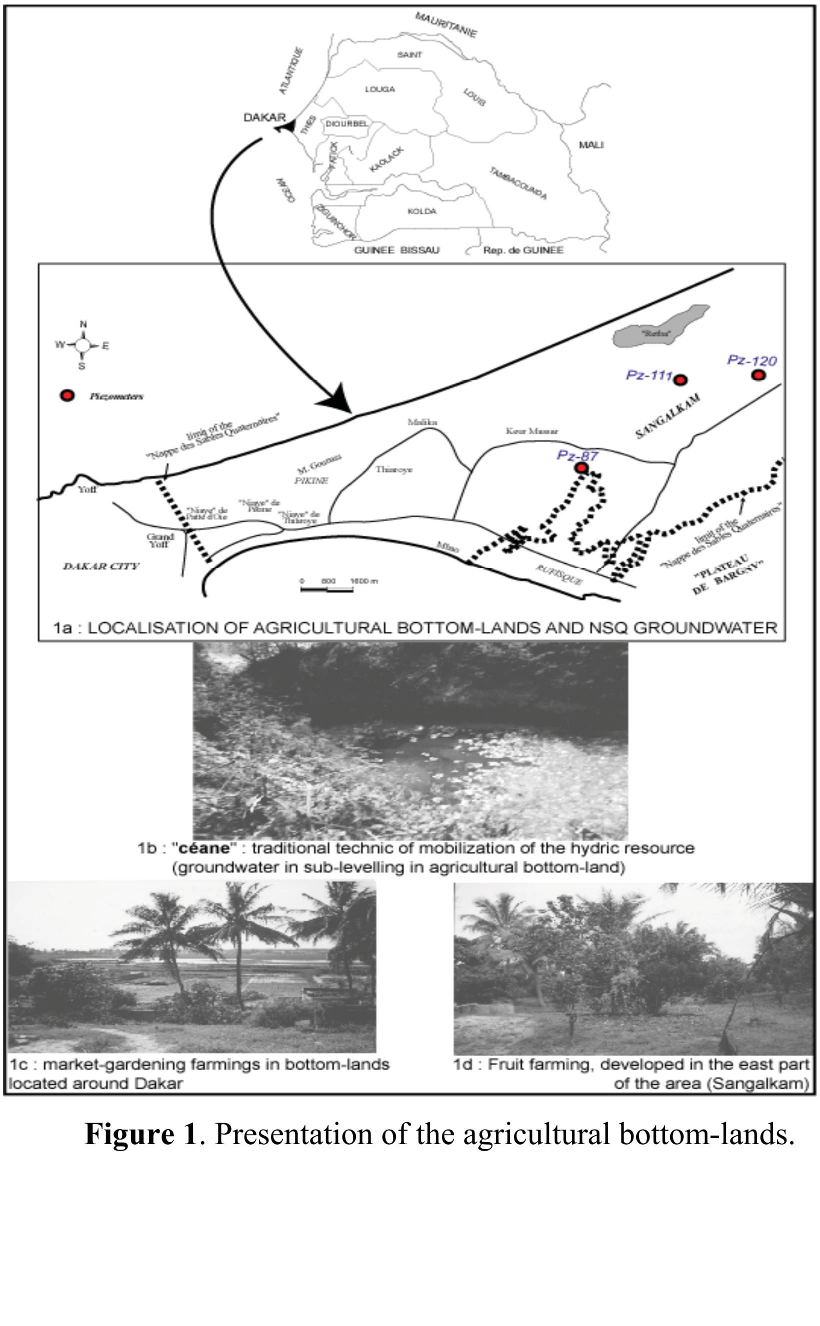


Figure 1. Presentation of the agricultural bottom-lands.

RELATED ISSUES AT THE WATER RESOURCE IN THE AGRICULTURAL BOTTOM-LANDS

THE CURRENT CLIMATIC CRISIS AS A MAIN CONSTRAINT

For a better evaluating of the climatic threats upon the hydric resources, the relative share of components of NSQ groundwater annual hydric balance will be specified. Reference data are the annual average hydric balance (from 1972 to 1984) calculated by Béture Sétame (1988). On figure 2, results (originally in $m^3\ j^{-1}$) are converted into precipitation equivalent by the formula: 1 litter / m^2 = 1 mm.

It is interesting to note that rains are the only "inputs", and hence precipitation variability has determining impacts on the recharge, i.e. on the "natural" evolution of the resource. Concerning "outputs", referring to Béture Sétame assessment, the relative shares of following factors are:

- natural outputs (Etr + losses to the sea) = 72,3%,
- anthropic withdrawals (Agriculture + Urban water supply) = 27,7%.

The NSQ level piezometric variation equation is:

$$\Delta_r = P - (Q_{sea} + Et + Q_a)$$

with: Δ_r = Reserve variation (= Piezometric level evolution or Resource evolution); P = Precipitations; Q_{sea} = losses to the sea; Et = Evapotranspiration; Q_a = Anthropic withdrawals

Given that rainfall as the only "input", its variability of the last 80 years focuses our attention. The evolution trend of annual precipitations shows a net difference since 1969. Before this date, the annual precipitation amount of Dakar area was relatively abundant, with an average close to 574 mm. Since 1969, a persistent rainfall crisis occurs in the area (Dasylva, 2001): the interannual average dropping down to 342 mm

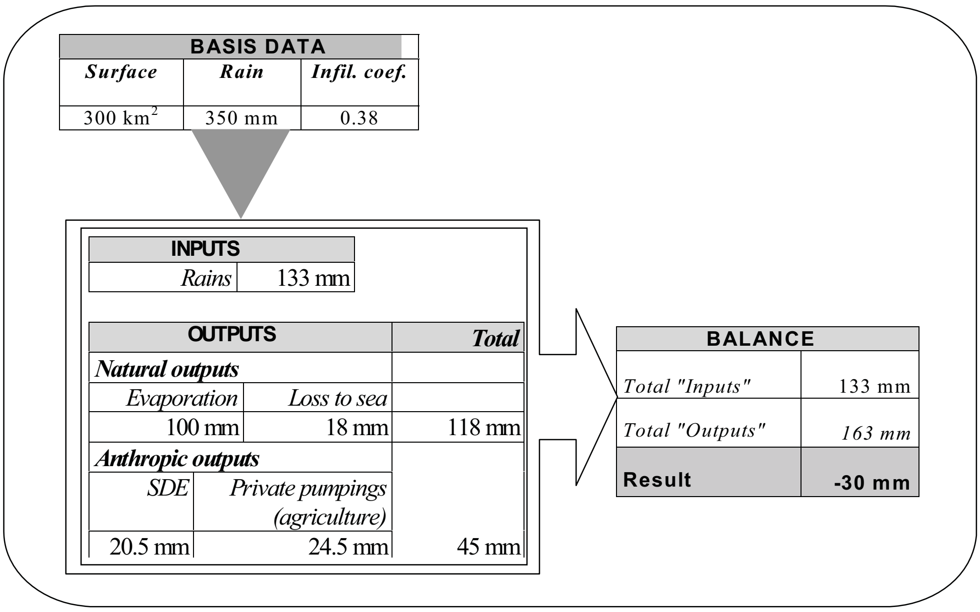


Figure 2. The annual average values of the NSQ groundwater hydric balance, from 1972 to 1984 (Béture Sétame, 1988)

(figure 3). The annual average rainfall deficit of this post-1969 dry phase is 231 mm (i.e. 40% of the previous average amount). If we refer to the drought threshold defined by Durand (1988), i.e. 20% deficit, the climatic crisis prevailing in the area is very severe and has negative consequences on the groundwater recharge (figure 4). In relationship at this water shortage context, it is important, 1/ to specify the impacts on the hydric resources in the region, and 2/ to promote technical measurements involving a better management of rainwater. It is a challenge to improve water availabilities for irrigation and water drinking activities, by enhancing groundwater recharge. The evolution of the SdE pumping volumes is a supplementary proof element of the water shortage context. SdE –Sénégalaise des Eaux- is a private company in charge of exploitation of the resources and the distribution of the drinking water. In relationship of hydrodynamical condition variations, in part related to climate change (Dasylva & Cosandey, 2006), the pumping volumes drop continuously: the maximum threshold passed from 15000 m^3j^{-1} in 1952 to 8000 m^3j^{-1} currently.

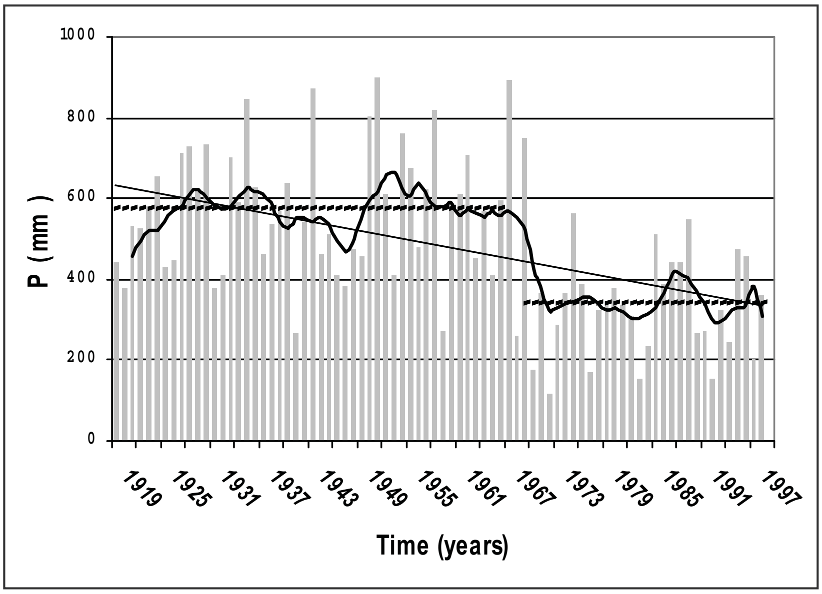


Figure 3. Rainfall evolution trends at “Dakar-Yoff” station, from 1919 to 1998.

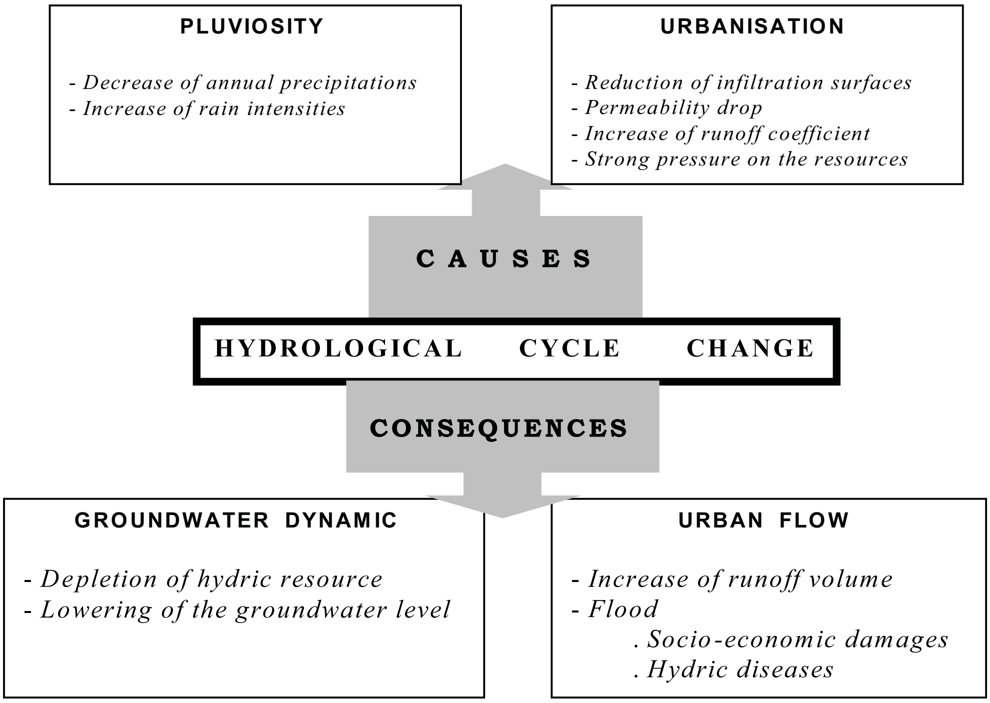


Figure 4. Factors and impacts of the hydrological cycle change.

IMPACTS OF THE URBANISATION ON THE HYDRODYNAMICAL CONDITIONS

Dakar area is characterized by a dramatic social pressure on the environment due to high population number (2.9 million in 2001) on a reduced surface (550 km^2). Moreover, land occupation without official authorization complicates the situation: lands are urbanized out of any control by official town-planning, mainly by poor populations. As a consequence, related constraints at the urbanisation are triple: 1/ strong pressure on the lands and the hydric resources, 2/ infiltration surfaces reduction and 3/ permeability drop of soil superior horizon (figure 4). The two last factors are leading to a decrease of infiltrating rainwater volume feeding the groundwater and an increase of runoff. Our previous studies showed that the infiltrating rate is higher in sectors the least urbanized -the eastern part of the region (Sangalkam)- compared to the sectors with strong urban pressure -zones located around Dakar- (Dasylva *et al*, 2004). However, in the perspective for promoting a participative rainwater management policy, it is necessary to find infrastructures adapted at this urban environment, and which could be appropriated by populations and local authorities. In this way, alternative technologies of rainwater management are the focal point of investigations; they are rarely used in Africa.

THREATS ON THE TRADITIONAL WATER RESOURCE MOBILIZATION TECHNIQUES

Agricultural bottom-lands are mainly located in the eastern part of the peninsula head (suburbs of Dakar city) in zones where urban density is very high. Near the city, the strong urban pressure on the environment implies that the size of farms is rather small. Farmers often use traditional techniques, designated by the vernacular term of "*céanes*" (excavations in the ground, reaching sometimes 2 meters depth, with an access path) for mobilizing the groundwater resource (figure 1b). An essential performance parameter of this traditional technique is that the top-level of the groundwater should not be far from the soil surface. However, recent climate evolution involves a continuous decrease of groundwaters top-table (figure 4), increasingly compromising the traditional agricultural activity performance. To preserve this activity, new technical measurements are necessary for mitigating the groundwater dropping process, and for maintaining its depth on an acceptable level. Eastward from Dakar city, in peri-urban zones where urban pressure is less heavy, the farm size becomes larger. Modern infrastructures of water resource mobilization (drillings and wells) are used to face anthropic water request. In the context of groundwater level drop, these infrastructures are a possible alternative to the traditional "*céanes*". But, the financial sizable cost is a limiting factor for farmers having low income.

The underlined issues in these paragraphs are as many parameters justifying the urgency of developing a sustainable water management policy in the region. Technological solutions should integrate both "resource/risk" dimensions of rainwater. That means they should have a double goal: enhance groundwater availabilities by increasing the rainwater infiltrating volumes and mitigate the flood problems. Two hydrodynamical variables of the NSQ groundwater -"recharge" and "rainwater infiltrating rate"- will be studied to illustrate possibility of improving the management of rainwater. Their evolution according to pluviosity variability provides responses elements of the groundwater reaction at the change of hydrodynamic conditions. Thereby, they are key elements for the understanding and the solution of the groundwater depletion problems.

DETERMINATION OF INDICATORS SUPPORTING A SUSTAINABLE GROUNDWATER MANAGEMENT: "*recharge" and "rainwater infiltrating rate" variabilities*

METHODODOLOGY

The "recharge" and the "rainwater infiltrating rate" are analyzed through the volume of infiltrating rainwater reaching the groundwater, symbolized by the variation of the groundwater altitude level. In our previous studies (Dasylva, 2001), piezometric data concerning the NSQ groundwater -from 1953 to 1992- were used to study the groundwater behaviour. However, available data are monthly, corresponding at the measurements of one day or a few consecutive days. Consequently, the groundwater behaviour can be studied only on a monthly scale. In this paper, piezometers Pz 87 (or n° 87), Pz 111 (or n° 111) and Pz 120 (or n° 120) are selected for measuring rainwater volume feeding the groundwater. They are localised in the eastern part of the area (*cf.*

figure 1) and they are representative of groundwater behaviour variability in this zone. Their functioning is considered as “natural” because it responds to rainfall variability and not to SdE pumping and saline water intrusions (Dasylva *et al*, 2003).

For measuring the variation of groundwater top-level, in order to determinate the volume of infiltrating rainwater feeding the groundwater, our method uses the MVSL - monthly variation of the static level- (table 1) or the net values of the groundwater altitude (GA) change between two consecutive months. This variation is positive or negative in relationship with the interactions between the hydric balance components. The method allows us to determine the characteristics of the hydrological year, i.e. to identify its duration and both recharge and discharge periods (figure 5a). The recurrence of monthly volumes of infiltrating rainwater are represented by the positive variation of the static level. The cumul of all MVSL values is carried out on the CMVSL (cumulated monthly variation of static level) column (table 1): the results gives directly the net values of variation of the hydric resource in the time (figure 5b). The maximum level of the variation represents the net values of “recharge” generated by infiltrating rainwater. The minimum level indicates the final budget of the stock during the hydrological year. The balance is positive when the final budget is above zero and is negative when the final budget is below zero.

This method is a mean to solve the problems of groundwater altitude heterogeneities and to be able to compare all sites on similar bases: the hydrological year starting is fixed at zero for all piezometers (red line). In irrigation, the CMVSL method provides data on the hydric resource temporal variation (figure 5b), more precisely the starting (1), height (2), duration (3) and end (4) of the rainwater inputs, and the final budget (5).

The approach is original in comparison to most of the previous researches in this zone, realized by hydrogeologists which were only focused on the hydrogeological characteristics, delivering results in volume -m^3- [(Anonyme, 1963); (Béture-Sétame, 1988); (Fohlen & Melka, 1989); (Gaye *et al*, 1977 and 1998); (Géohydraulique, 1972); (Henri, 1921 & 1922); (Martin, 1969 & 1970); (OMS, 1972); (Tandia, 1993 & 1997)]. These researches do not take into consideration the hydrological relations between the groundwater and the “niayes” or agricultural bottom-lands.

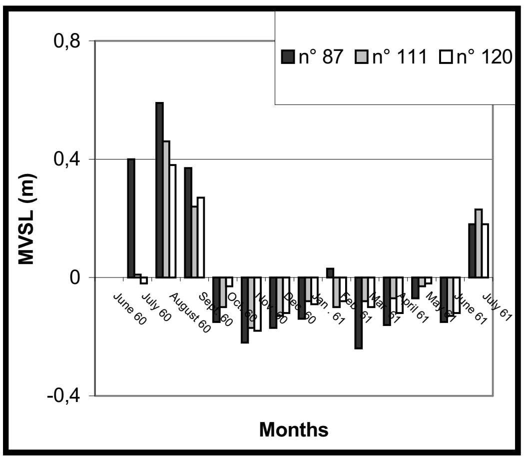


Figure 5a. Representation of the monthly variation of the static level (MVSL).

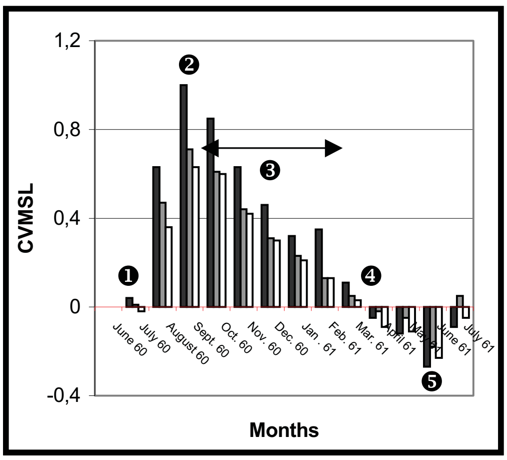


Figure 5b. Representation of the cumulated monthly variation of the static level (CMVSL).

G MOIS	n° 87			n° 111			n° 120		
	GA (in m)	MVSL (in m)	CMVSL (in m)	GA (in m)	MVSL (in m)	CMVSL (in m)	GA (in m)	MVSL (in m)	CMVSL (in m)
June 60	10,57	0	0	2,97	0	0	4,62	0	0
July 60	10,61	+0,04	0,04	2,98	+0,01	0,01	4,6	-0,02	-0,02
August 60	11,2	+0,59	0,63	3,44	+0,46	0,47	4,98	+0,38	0,36
Sept. 60	11,57	+0,37	1	3,68	+0,24	0,71	5,25	+0,27	0,63
Oct. -60	11,42	-0,15	0,85	3,58	-0,1	0,61	5,22	-0,03	0,6
Nov. 60	11,2	-0,22	0,63	3,41	-0,17	0,44	5,04	-0,18	0,42
Dec. 60	11,03	-0,17	0,46	3,28	-0,13	0,31	4,92	-0,12	0,3
Jan. 61	10,89	-0,14	0,32	3,2	-0,08	0,23	4,83	-0,09	0,21
Feb. 61	10,92	+0,03	0,35	3,1	-0,1	0,13	4,75	-0,08	0,13
Marsh 61	10,68	-0,24	0,11	3,02	-0,08	0,05	4,65	-0,1	0,03
April 61	10,52	-0,16	-0,05	2,95	-0,07	-0,02	4,53	-0,12	-0,09
May 61	10,45	-0,07	-0,12	2,92	-0,03	-0,05	4,51	-0,02	-0,11
June 61	10,3	-0,15	-0,27	2,79	-0,13	-0,18	4,39	-0,12	-0,23
July 61	10,48	0,18	-0,09	3,02	0,23	0,05	4,57	0,18	-0,05

A = groundwater altitude
MVSL = monthly variation of the static level
CMVSL = cumulated monthly variation of the static level

Table 1. Method for calculating the groundwater reaction under the impulse of infiltrating rainwater.

The CMVSL method used in this paper makes it possible to determine the relationship with the bottom-lands functioning. It presents one disadvantage: results apply to monthly average and not to daily value.

In relation to the characteristics of precipitations, infiltrating rainwater volume reaching the groundwater is calculated according to three annual pluviometric models : 1) annual rainfall (529 mm) close to the regional average (484 mm) ; 2) annual rainfall on excess (10 years recurrence : 712 mm) ; and 3) insufficient annual rainfall (20 years recurrence : 220 mm). These precipitation data are the annual values recorded respectively in 1960, 1969 and 1970. They are representative of interannual pluviosity variability of the last 80 years and they have monthly piezometric data available.

RESULTS

RECHARGE AND INFILTRATING RAINWATER RATE

The recharge corresponds at the maximum level of the CMVSL (figure 6). Results are indicated in table 2: values in meters (m) represent the height variation of the groundwater static level in the aquifer, and values in millimeters represent this variation in equivalent precipitation height. This latter calculation is based on 0.15 porosity value in sand dunes (Béture-Sétame, 1988). The initiation of the recharge shows that the groundwater responds rapidly at pluviometric impulses because the level is near from the soil surface in the bottom-lands and the soil permeability is strong (Dasylva *et al*, 2003). The main information shown by theses results is that the evolution of both recharge and pluviosity phenomena is quantitatively dependent: the average height of the recharge is in direct dependence of rainfall variability (table 2).

The infiltrating rainwater rate (or share of precipitation volumes reaching the groundwater) is the ratio 'Volume of the recharge'/'Annual precipitation amount'. The results also illustrate a variability dependent on the sites location and on the annual precipitation amounts. The estimated averages values are 9, 22.5 and 30.5 %, respectively for low, normal and excess years (table 3). Like for the recharge, it is logical to observe a link between variabilities of infiltrating rainwater rate and precipitation amount. More the infiltrating water potential (precipitation amount) is high, better is the groundwater recharge (infiltrating rate). This indicator is a fundamental element of the rainwater management strategy proposed in this paper.

RELATION INFILTRATING RAINWATER VOLUME CHANGES / FINAL BUDGET OF GROUNDWATER LEVEL BALANCE

First, it is important to note on figure 6a and 6c, in spite of variability of the recharge, the budget at the end of the hydrological year is almost identical for all piezometers. This phenomenon is caused by the static level rebalancing process: this parallelism between responses indicates that the piezometers selected are representative of the global groundwater behaviour in this zone.

Impacts of infiltrating rainwater volume changes on the final budget of the static level balance are indicated by the CMVSL level variability at the end of the hydrologic year. By referring on figure 6, results give negative values in two annual pluviometric scenarios: dry and average years (figure 6a, 6b). This means that infiltrating rainwater are insufficient to ensure an effective recharge of the groundwater, which would allow facing at the climatic and anthropic requests. Reversely, the budget is positive when the annual precipitation amount reaches 700 mm: thus, a wet pluviosity of decennial recurrence is necessary to recharge positively the groundwater (figure 6c).

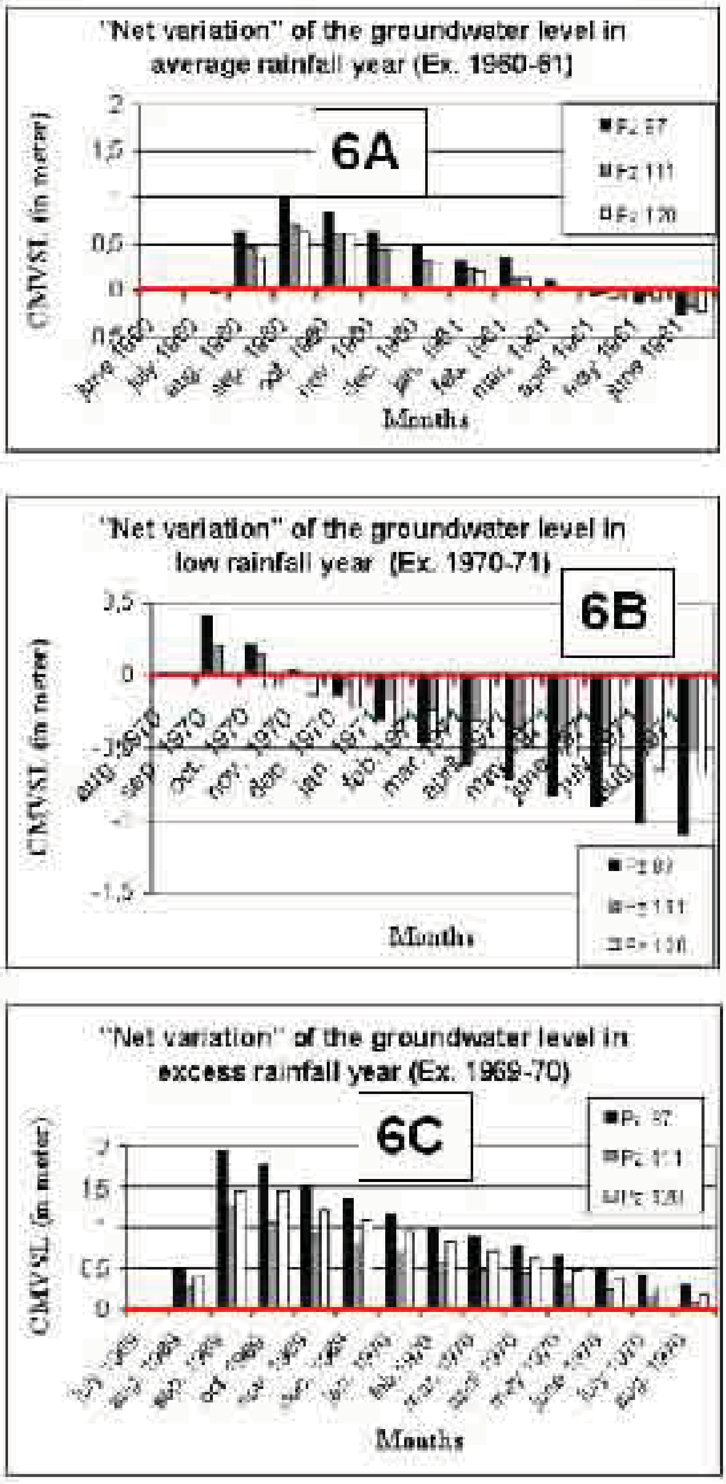


Figure 6. The net values of hydric resource variation according to annual precipitation amount variabilities.

Rainfall values	*n° 87*		*n° 111*		*n° 120*		*Average*	
	m*	mm**	m	mm	m	mm	m	mm
P = 529mm	1	150	0.71	106	0.63	94	0.78	116
P = 712mm	1.93	290	1.25	187	1.44	216	1.54	231
P = 220mm	0.41	61.5	0.21	31.5	0	0	0.2	31

*= net values of cumulated monthly variation of static level in the aquifer during the recharging phase
**= height equivalent of the variation by comparison to precipitations

Table 2. Estimate of recharge net values in three rainfall scenarios.

Rainfall values	*n° 87*	*n° 111*	*n° 120*	*Average*
P = 529 mm	29,4%	19,6%	18,4%	22,5%
P = 712 mm	38,4%	24,8%	28,3%	30,5%
P = 220 mm	18%	10%	0%	9%

Table 3. Estimate of the infiltrating rainwater rate reaching the groundwater according to rainfall variability.

Currently, pluviometric context is characterized by annual precipitation amounts close in best cases to the regional average; consequently the NSQ groundwater is not being refilled sufficiently. This unfavourable context is leading to processes of declining of NSQ water table and drying of the agricultural bottom-lands. Coastal zones are not concerned by the lowering of the groundwater table, since groundwater table level is about the same as that of the sea (Dasylva *et al*, 2003).

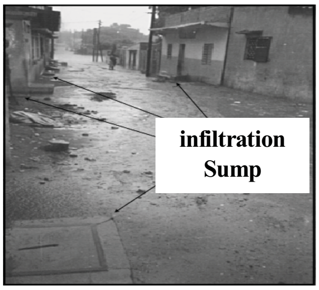
DISCUSSION: RAINWATER EFFICIENT MANAGEMENT / GROUNDWATER AVAILABILITIES INCREASE

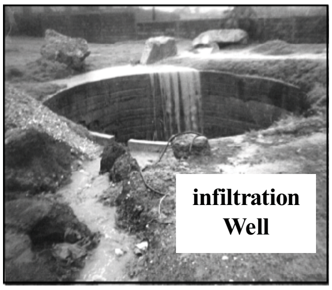
As outlined above, any rainfall increase seems nowadays hypothetical, given the low rainfall recorded for the last 30 years. Therefore the "efficient" recharge is not and probably will not be occurring in the near future. Then, alternative solutions may emerge to improve runoff management. However, a sustainable rainwater management policy implies to implement actions will have positive impacts on both groundwater behaviour and rainwater drainage network performance. Furthermore the runoff volume increase, the inefficiency of solutions is also due to the reduction of the transfer capacity of drainage network. This dysfunction is caused by the decantation of the solid load contained in the flows. Concerning strategies used to solve the surface water problems, some management practices existing in the African cities (more precisely in Sahalian zone) are matter of debate (Dasylva *et al*, 2002). In the case of Dakar, rainwater management "classical" systems evacuate drained waters (more and more important) toward the sea and/or evaporation basins; in a rainwater scarcity context, and with the possibility of storing water in the sand dunes, this strategy leads to a loss of resource (Dasylva *et al*, 2004a). Rainwater must not be considered as a harmful element but a resource. In an international context where researchers are increasingly determined to find adaptive solutions to the climatic change, a sustainable management of water resources constitutes a strong recommendation.

A better management of runoff is necessary and possible. This viewpoint is showed by the groundwater dynamic changing according to rainfall variability and the water management technique and policy problems. In relationship with the problematic of this paper, the challenge is to find alternative solutions to improve water availabilities (i.e. the groundwater recharge)- exploited by the irrigation and other activities. Technological measurements will have the objective of maximizing the infiltrating water volume in the dune sands. By transferring water from risk zones (urbanized area) toward milieus allowing a positive use (groundwater aquifer), this prospect is a mean to produce safe supplementary (or unpolluted) hydric resource for irrigation. Then, rainwater harvesting policy are interesting perspectives. Research in Africa showed that runoff can constitute a complementary hydric resource [(Valet & Sarr 1999); (Lamachère & Serpantié 1990)]. In the case of Dakar agricultural bottom-lands, the increasing of the infiltrating rainwater rate by artificial means is the most evident factor that would

a better replenishment of the NSQ groundwater. The groundwater level decrease in the "niayes" in an average pluviosity context, could be stopped by increasing the infiltrating rate of the rainfall to 50% (Dasylva *et al*, 2004b). An efficient management of surface water requires an intervention in the upstream zones by using rainwater harvesting technologies allowing an infiltration and storage of water in the dune sands reservoir. Goals are to decrease the runoff volume (for mitigating the flood problems) and enhance the groundwater recharge (for reducing the losses due both by direct evaporation and the diverting of rainwater to the sea). Being in urban and peri-urban contexts, "habitats" and "streets" would be the prime spatial reference units, i.e. the firsts level of intervention. Technical issue is to find the infrastructures adapted at these sites. By referring at local practices, sumps and wells -only intended to rainwater- are technologies selected to increase the infiltrating rainwater rate, respectively installed in the concessions and the streets (figure 7). To strengthen the rainwater drainage network, a massive use of these techniques -classified in the alternative technologies of rainwater management (S.T.U., 1989; Chaïb J., 1997) is suggested. The local population knowledge is an advantage to facilitate the appropriation. Feed backs on water management show that the success and the duration of solutions needs to imply local communities in the process. Moreover, in relationship with the limits of the rainwater drainage network functioning and the insufficiency of means mobilized by official services, a correction of the current system in a participative way, integrating various stakeholders, is necessary. Today, it is a challenge of increasing numerically the infrastructures and implying the population in the maintenance.

However, this artificial recharging must be "controlled" in order to limit the contamination of the groundwater by infiltrating water from polluted zones, for example the household refuse discharges [(Tandia *et al*, 1997); (Tandia, 1993); (Collin & Salem, 1989); (Gaye *et al*, 1977)].





Sumps: used on this photo –“Grand Yoff” district- to infiltrate domestic waters
Well: used on this photo –“Technopole” site- to infiltrate runoff

Figure 7. Local practices as regard wastewater and rainwater management techniques.

CONCLUSION

For coping with the sensitive problem of the water scarcity in Sahalian zones, an alternative solution is to manage better the runoff for improving water resource availability, in addition to benefits which would be produced by a rational use. For this purpose, our paper suggests to implement a new strategy based on rainwater harvesting systems for storing water in the dune sands reservoir. By taking in consideration urban and peri-urban contexts and in accordance with water management practices used in Dakar, rainwater infiltrating technologies leading to a participative management are suggested; elsewhere they should be selected by referring to the local techniques. Beyond technical measurements, the benefit to consolidate and to promote is the scientific approach used to determine issues and solutions for improving the rainwater management efficiency. The strategy –increasing rainwater infiltration rate toward sand dunes reservoir by proximity water absorbing infrastructures- derives from a four “step-study”, illustrated on figure 8. In the three first steps, salient issues of the region are defined by taking into consideration the interactions between physical and social environments and the water management practices. The underground storage choice is determined by 1) the possibility of reusing infiltrated waters, and 2) the necessity to preserve water resources from climatic request or evapotranspiration.

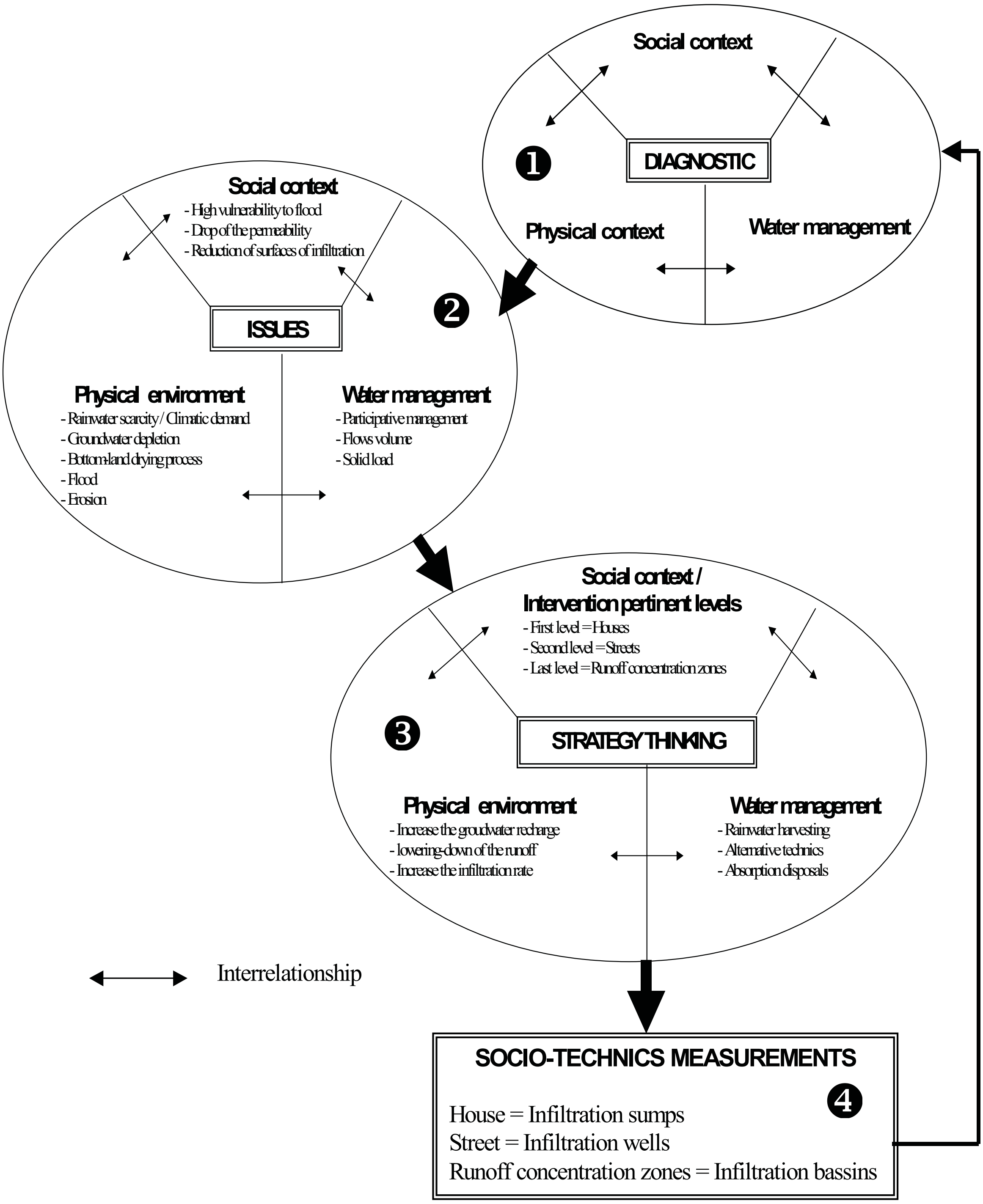


Figure 8. Strategy building process of a sustainable rainwater management applied to Dakar region.

BIBLIOGRAPHY

1. Anonyme. 1963. Etude hydrologique des «niayes» du Cap-Vert. Synthèse des données existantes. 28 p.
2. Béture-Sétame. 1988. Renforcement de l'approvisionnement en eau de la région de Dakar. Tome 5. Dakar.
3. Chaïb, J. 1997. Les eaux pluviales: gestion intégrée. *Sang de la Terre*. Paris. 173 p.
4. Collin, J. J. and Salem, G. 1989. Pollution des eaux souterraines par les nitrates dans les banlieues non assainies des pays en développement: le cas de Pikine (Sénégal). *Symposium SISSIPA*. Lisbonne.
5. Dasylva, S.; Cosandey, C., 2006. L'exploitation de la nappe des sables quaternaires pour l'alimentation en eau potable de Dakar: une offre compromise par l'insuffisance de la recherge pluviométrique. *Géocarrefour*. 80(4): 349-358.
6. Dasylva, S.; Cosandey, C.; Orange, *et al*. 2004b. Rainwater infiltration rate and groundwater sustainable management in the Dakar region. *Electronic Journal of International Commission of Agricultural Engineering*. Vol. 6.
7. Dasylva, S.; Cosandey, C. *et al*. 2004a. Acuité des problèmes lies à l'eau et la nécessité d'une gestion "ntégrée" des eaux pluviales dans le domaine des sables dunaires de la Région de Dakar. Colloque Développement Durable: leçons et perspectives. Ouagadougou.
8. Dasylva, S.; Cosandey, C.; Orange D. *et al*. 2003. Assèchement des «niayes» (bas-fonds agricoles) de la Région de Dakar durant la période 1960 – 1990: variabilité spatiale et rôle joué par la pluviosité. *Sud Science et Technologie.* Vol. 11. 27-34.

   Dasylva, S.; Cosandey, C. and Orange, D. 2002. Proposition de gestion «intégrée» des eaux pluviales pour lutter contre les problèmes liés à l'eau dans la banlieue de Dakar. *Colloque Envirowater 2002.* Ouagadougou.
9. Dasylva, S. 2001. Les bas-fonds des sables dunaires de la Région de Dakar: potentialités agricoles et contraintes urbaines. Thèse de doctorat. Univ. Paris 1-Sorbonne. 405 p.
10. Durand, J. H. 1988. Arrêter le désert. Techniques vivantes. PUF. Paris 416 p.
11. Fohlen, D. & Melka, J. 1989. Etude des ressources en eau du Sénégal. Synthèse des récentes campagnes de prospection géophysique. BRGM. Dakar. 60 p.
12. Gaye, C.B.; Faye, A. *et al.* 1977. Analyse des processus de minéralisation et de dégradation de la qualité de l'eau dans les nappes infra-basaltiques et des sables quaternaires. Projet CRDI 3-P86-1014. Dakar. 94 p.
13. Géohydraulique.1972. Etude sur modèle mathématique du système aquifère de la presqu'île du Cap Vert. OMS. Dakar.
14. Henry, H0. 1922. Etudes hydrologiques en vue de l'alimentation en eau des villes de Dakar et de Rufisque. (*unpublished*).
15. Henry, H. 1921. Eaux superficielles et souterraines au Sénégal. Larose. Paris. 30 p.

16. Lamarchère, J.M. and Serpantié, G. 1990. Valorisation des eaux de ruissellement et lutte contre l'érosion sur champs cultivés en zone soudano-sahélienne (Burkina Faso). Montpellier: VI^{e} Journ. Hydrol. de l'Orstom. 1990. 14 p.

17. Martin, A. 1970. Les nappes de la presqu'île du Cap-Vert, leur utilisation pour l'alimentation en eau de Dakar. BRGM. Dakar. 56 p + cartes.

18. Martin, A. 1969. Interprétation des variations naturelles du niveau des nappes aquifères en Mauritanie et au Sénégal. Nappe de la presqu'île du Cap-Vert. BRGM. Dakar.

19. Service Technique de l'Urbanisme. 1989. Mémento sur l'évacuation des eaux pluviales. La Documentation Française. Paris. 349 p.

20. Tandia, A.A.; Gaye, C.B. and Faye, A., 1997. Origine des teneurs élevées en nitrates dans la nappe phréatique des sables quaternaires de la région de Dakar, Sénégal. *Sécheresse*. 8(4): 291-294.

21. Tandia, A.A. 1993. Origine, évolution et migration des formes de l'azote minéral dans les aquifères du Sénégal: cas de Thiaroye (banlieue non assainie). Rapport AIEA. Dakar, n°7272/RB.

22. Valet, S. and Sarr, PS. 1999. Concept du report hydrique superficiel (runon). Strasbourg, 24es Journées scientifiques du GFHN. 2 p.

LIVES OF MARGINAL COMMUNITIES IN THE DROUGHT PRONE AREAS OF SOUTH INDIA: A CASE STUDY OF ANANTAPUR DISTRICT OF ANDHRA PRADESH

Eswarappa Kasi[1]*

ABSTRACT

The term 'Livelihood' has different connotations in the development studies after 1980's all over the world. Studies relating to Livelihoods have got prominence during the same time in the developed and underdeveloped nations of the globe. Studies on marginal communities though reflected earlier specific cases on livelihoods have not dealt with before. By using both primary and secondary data sources, this paper points out that shocks and natural causes, such as drought in the South India, particularly in Anantapur District, have contributed to a decline in livestock and crop yields and increased poverty levels in the region. Therefore, alternative livelihood options that can diversify rural incomes from agricultural production need to be identified. In this process government with the assistance from the donor agencies initiated the 'Watershed' development activities which got prominence in the district and received boost and laurels in the drought affected areas of Anantapur district of Andhra Pradesh in South India.

The present paper is an outcome of my project work undertaken in the Anantapur District of Rayalaseema Region of South India. The project work is carried by using participatory tools and techniques in addition to anthropological methods in collecting the information from the respondents and beneficiaries of the scheme 'Watershed Development' in the Study Area. The paper also explains how the livelihoods of the people have transformed due to the new approach and its impact on their daily activities. Further it also explains the nature of development undergone in the study villages.

Key Words: Livelihoods, Marginal Communities, Drought, Case Study, Watershed, Anantapur District and South India.

1- ICSSR Senior Doctoral Fellow, Department of Anthropology, University of Hyderabad, Central University (P.O.), Hyderabad- 500 046, Andhra Pradesh, India.
kasieswar@gmail.com, kasiehcu@lycos.com

I- INTRODUCTION

A majority of development programmes were initiated for improving the situation of the marginalized in the society. There has also been a sizable body of research, which explains about the conditions of the marginalized people and these studies have also tried to explain both the conditions of the marginalized and the development programmes directed at them. Marginalized sections are swelling in number and are in a condition of destitution and living in innumerable conditions.

Traditionally, the discipline of Anthropology has been geared to study the socio-cultural and economic conditions of multiple communities by adopting the holistic approach which primarily differentiate this discipline from other sister disciplines. The primary means of understanding the situation of the marginalized has been through the rubric of deprivation. While this approach continues to be useful, it also runs the danger of reducing the subjects of its study to mere victims of larger processes in the development discourse. In other words, there is a tendency to see the marginalized as totally lacking in agency. It is as an important corrective to this tendency that the livelihoods approach was first taken up by scholars like Diana Carney and Scoons (1998). One of the important features of livelihood approach is that, it focuses upon people's assets (physical, natural, financial, human, social and political capitals). It also looks at how people utilize these assets and negotiate their problems. Most of the studies conducted in this area of development fail to map the issues of development from a holistic perspective where as livelihood approach which is dominating the contemporary developmental agenda tends to be more comprehensive and gained significance in addressing the problems of marginalised.

The present paper is organised into four parts/sections. First section briefly discusses the concepts, definitions and scope. The second section of the paper gives a brief sketch of the Watershed development initiative in Andhra Pradesh and in Ananthapur district. Third section analyses the livelihoods in the Village and brief sketch of the watershed and its related activities such as DWCRA and its role in Women empowerment in the area. Final section concludes with the positive aspects of the watershed programme in the area to control the drought conditions.

There have been many attempts, by different scholars, to define livelihoods. This would give us an idea before going into the empirical understanding of the marginal lives and livelihoods in the context of watersheds management in Ananthapur District of Andhra Pradesh. Chambers and Conway defined livelihoods as "the ways in which people satisfy their needs, or gain a living" (1992:5).

Carney offered an elaborate definition of sustainable livelihoods. "A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope up with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Carney, 1998: 2).

Livelihood Security means "Secure ownership of, access to, resources and income-generating activities, including reserves and assets to offset risk, ease shocks and meet contingencies" (Chambers, 1988: 2).

The marginal communities in the drought prone regions of India are overwhelmingly marginalized not only economically but also spatially, culturally, and otherwise. Andhra Pradesh has a significant proportion of tribal population and is ranked fifth in the country. Number of laws promulgated by the pre- and post-British India affected the tribals adversely. These laws have threatened their livelihoods and existence. These groups, who were forest dwellers, have been denied usufruct rights over forest produce. Land reforms have not benefited them in any significant way. Hence, they remain landless and, to some extent, even homeless. The lack of education has resulted in their exploitation by the non-tribals. Government officials have often colluded or remained apathetic to this situation.

Many development programmes have been directed towards the betterment of the marginal communities in Andhra Pradesh. Funding agencies like DFID is associated with the government to implement certain programmes to ameliorate the conditions of the destitute. Thus, DFID's sustainable rural livelihoods approach puts 'people at the centre of development'. Looking at the DFID approach, in Andhra Pradesh, participatory watershed programme is being implemented, where, at present, Andhra Pradesh Rural Livelihoods Project (APRLP) project aims to scale up ongoing watershed programme activities in the State by supporting in the areas of capacity building, livelihood support and convergence of other schemes and services, collectively called 'watershed plus'. The project is expected to assist in macro policy evolution relating to evolving effective and sustainable approaches to reduce poverty in the five drought prone districts of the State. The project adopts a participatory sustainable rural livelihoods strategy, which is based on an analysis of the capital assets (physical, social, human, natural, financial and political) from which the rural poor makeup their livelihoods (APRLP, 1999).

II- WATERSHED DEVELOPMENT PROGRAMMES IN ANDHRA PRADESH (A.P):

With a total geographical area of 274,400 km, Andhra Pradesh is the fifth largest state of India. The state consists of 23 districts comprising 1,104 revenue mandals. The economy of Andhra Pradesh is predominantly agriculture oriented. According to the population census of 2001, the population of the sate is 75.7 million. The population density being 275 persons per km. almost 75% of the population live in rural areas with 70% depending on agriculture as the main source of living. The importance of agriculture sector is further underlined by the fact that almost 70% of the states work force is engaged in agriculture and allied activities. Due to the high population growth, the share of agricultural labourers shows an increasing trend, indicating that increasing man-land ration lead to severe problems of productivity absorbing the growing rural population in the agriculture sector. Andhra Pradesh has one of the highest shares of agricultural labourers in the total work force of all Indian states. Landless families constitute upto 60% of total households in certain districts of the state.

Though productivity has increased in the lat 25 years, the standard of living has not improved. About 54.2 percent of the land holdings are classified as marginal. Recent demographic interpolation estimate that 18% and 4% of Andhra Pradesh population belong to Scheduled Castes and Scheduled Tribes. According to the latest estimates, almost one quarter of the total population of Andhra Pradesh lives the below poverty line.

DROUGHT PRONE AREA PROGRAMME (DPAP):

This is centrally sponsored programme funded by Central and State governments on 50:50 basis aiming at developing the drought prone areas with an objective of drought proofing by taking up soil and land moisture conservation, water harvesting structures, afforestation and horticulture programmes on a comprehensive micro watershed basis. During 1994-95, the programme was implemented in 69 blocks of 8 Districts. From 1995-96 this programme was extended further in 11 Districts with 94 blocks under the scheme and in Ananthapur District 16 blocks under Desert Development Programme (DDP).

While DPAP is targeted towards the semi-arid and dry sub-humid areas, DDP designed specifically for improved natural resource management and environmental protection measures in the arid areas of AP State. Besides this delineation of geographical target areas, there are virtually no difference between DPAP and DDP as regard to operational guidelines, eligibility of erosion control and SWC measures etc., except that under DDP the cost norms are higher (Rs. 4500 to 5000 per ha.) than for DPAP projects (Rs. 4000 per ha.). The main criterion for inclusion into DPAP is the share of irrigated land at the block level, the current ceiling being 20%. The total number of blocks covered under DPAP is 94, while 16 blocks have been identified for DDP. These 110 blocks represent one third of the total number of 330 blocks in AP State.

WATERSHED DEVELOPMENT IN ANANTHAPUR DISTRICT:

Ananthapur District is a hot arid district and falls in rain shadow zone with a very low estimated annual rain fall of 520 mm, which is second lowest in the country after Jaisalmar in Rajasthan. In the district, area is fully undulating with ridges and valleys with black cotton soils in certain areas. Out of the total rainfall received only 10-15 percent is utilizable for agriculture the rest is going waste through streams into sea and evaporation. Due to large number of water conservation and water harvesting structures taken up in the district during 1993-94 and 1994-95, 1000 M.cub of additional ground water recharge was made possible.

The entire district is declared as hot arid due to severity of soil erosion, high temperatures, and low and erratic ad uneven distribution of rainfall resulting in 'soil and moisture stress', excessive evaporational losses and crop losses as the ultimate effect of drought and high aridity index. Trends of desertification are also seen in parts of district. The district is unfortunately had skipped from drought prone to hot arid district. Ground water levels are alarmingly receding. Further degeneration of existing marginal and degraded forests had happened in the last 4 decades and acute scarcity of drinking water, fodder and fuel is taking place in every alternative year which is a serious drought year. All these factors are creating tremendous concern and awareness regarding the danger that is looming large among the masses of the district.

Ananthapur district mainly depends on South- West and North-East monsoons. Normally South –West monsoon rains useful for rainfed dry crops. But failure of two monsoon hits the district drastically leading to drought. The following physical symptoms are indicative for beginning of desertification trends.

- Hardly 10 percent of land mass available in the district is covered with forest
- Most of the hillocks and hill ranges are barren without any sort of vegetation. The top soils having been washed away due to very strong erosion factor.
- About 30% of hills are declared to be dead hills where nothing can grow because of the fact that there is not top soil on the hills except granites boulders and weathered rocks.
- Levels of ground water are going down year after year owning to low rainfall and over exploitation and not proper use and wastage of water.
- A remarkable and unique feature of the district is the high intensity of winds after experiencing the maximum temperature during summer and at the time of onset of monsoons.

To combat the recurring drought and to bring comprehensive development, the DPAP programme was introduces in the year 1975 covering all the blocks in the district. This programme is implemented on area approach basis with watershed development concept. Accordingly, several developmental strategies were implemented with a view to conserve soil, harvest and conserve rain water bringing out change in cropping pattern, organizing people in Self-Help Groups (SHG's), development of Dryland horticulture, sericulture and promotion of social forestry and integrated rural development.

However, with all the developmental strategies carried out under DPAP upto 1994-95 nearly 2.62lakh hectares out of 19.5 lakh hectares of geographical area could be covered and about 2.07 lakh individual beneficiaries could be assisted. At this stage trends of desertification were noticed in various parts of the district. It is declared as hot arid district and programme of DDP is introduced in the year 1995 onwards. In this programme a concerted integrated micro watershed development approach was envisaged under Dr. Hanumantha Rao new guidelines of Government of India. According to this, area of watershed would be approximately 500 ha, and programmed to spend Rs.22.50 lakhs in each watershed. Out of which Rs.18.00 lakhs will go for works component and Rs. 4.50 lakhs for community organisation and administrative cost. It is contemplated to execute the works and to implement the programme through NGO's and Government, officials as Project Implementation Agency (PIA).

An integrated action plan for a project period is prepared for the watersheds programmes for the district as detailed below. In micro watersheds the developmental works is being taken up by the watershed committees with the help of SHG's and user groups under the supervision of watershed development team, PIA's and Multi Disciplinary Teams.

Integrated Action Plan for Watershed Programme in Ananthapur District

Batch	Number of Watersheds	Funding Agency	Total Watersheds
1st Batch 1st Batch	141 96	EAS DDP	237
3rd Batch 3rd Batch	10 20	DDP World Bank	30
4th Batch	100	DDP	100
5th Batch	96	DDP	96
6th Batch 6th Batch	60 89	DDP RIDF	149
Total			612

Source: Commissioner of Rural Development, Government of Andhra Pradesh, Hyderabad.

PRIORITIZATION OF WATERSHEDS

Taking into priority ranking given by Andhra Pradesh State Remote Sensing Application Centre (APSRAC), SC, ST, population percentage of literacy, percentage of agricultural labour, scarcity of drinking water, quality of drinking water, availability of DWCRA, status of ground water, contiguity with existing watershed, livestock population and community mobilization etc. 3600 watersheds were prioritized very high, high, medium, low and very low categories. The above mentioned programme is being implemented in the Mallapuram village, which is described below along with the related development programmes such as DWCRA and role of watershed programme in the empowerment of women in the area.

III- LIVELIHOODS OF MALLAPURAM

Focused Group Discussion was conducted in the Mallapuram where knowledgeable persons from all communities have participated in the meeting. Following people have been divided into participants and facilitators: The issues that have been discussed are Droughts, migration and watershed programme.

Drought conditions for last 5 years: - People who were attended the FGD have revealed that droughts have affected their livelihood systems. Except last year i.e, 2000-2001, remaining four years, their yielding has reduced drastically. They said that farmers, labourers and petty business people have equally affected from the drought. People who were practicing animal husbandry i.e., dairying have felt that, their yielding was reduced due to the droughts but due to the watershed programme over this area, we could have minimized our losses.

Migration: - With regards to migration, people have told that they were not migrating to other areas i.e, Ballary etc. Labourers are going to Kalyandurg for wage work and return back in the evening but not staying in the work place. Participants have felt that inspite of severe droughts in other nearby villages; we did not face such severity. They said that due to watershed programme our people use to get minimum wage works in the village. They also felt that because of the Kalyandurg, (Mandal), which is very near to them, they are used to get wage works without any problem.

How Harijans or Dalits / landless people affected from the droughts: - People felt that due to droughts they were not affected badly but wage works have reduced comparatively. But then, due to watershed programme and availability of labour in the town (Kalyandurg), we were not affected severely. Scheduled castes people are supported by Rural Development Trust (RDT) an NGO, as said by Hanumappa and Thimmakka. Scheduled castes farmers have felt that very few people have irrigated lands and others have either dry land or landless people. Some of the Landless people are going to non- form activity works to Kalyandurg, where as others are going for wage labour in the village itself.

Backward castes: - Majority of the B.Cs. have the lands both irrigated and rainfed lands. Some of them are maintaining autos (total 10) individually. Three other people are running rented autos. They felt that due to watershed programme, they were not faced the severity of the droughts except reduce of yielding in the cultivation. They said that they are aware of the important programmes like watershed programme etc. People felt that Mallpuram is much adjoined to the town, so their awareness level has also increased. Due to heavy rains, last year their groundnut yielding has reduced according to Ramanjaneyulu.

Women: - Women felt that due to the watershed programme, their awareness has increased enormously. Self help groups and DWACRA groups have increased their savings capacity and women are attending the group meetings and also Mahila Mandal meetings outside of the village.

RISK LIVELIHOODS IN THE VILLAGE:

The risks marginal groups faced during the drought period is also surveyed during our field work, which is explained as in the form of a case study below.

CASE OF LINGAMMA:

Lingamma (female) is the chairman of women's watershed committee, which is situated in the village. She has three sons where two of them, have studying BSc. and working as assistants with doctors. She is maintaining herself all the works, as watershed chairman, household work and also managing petty business shop in the village simultaneously. She has 2 ½ acres of land in village, which is of rainfed in nature.

Lingamma has said that out of three years (1998-2001) only 1999-2000 year she has got the crop, remaining two years she could not get even input cost, so she faced severe financial crises. Another reason for the crisis is that of education of children. She also said that "I could not study even 5th class. But let my children study as much as they can.

Lingamma's main occupation was being petty business in the village all the general store items, are available in the shop, including wheat flower and Groundnut oil. She also said that from the beginning (after her marriage) onwards, they are mainly depended upon petty business. This is because of their separation from her in-laws house, which was around 15 years back. After their separation she could not get even one acre of land from their (her) in-laws. So they started petty business.

Lingamma has said that, year by year, input cost on agriculture is increasing enormously and farmer's livelihoods have not been improving or increasing, as that of input cost of agriculture. Yielding is also very less according to Lingamma.

Lingamma has said that seven years back she has good income both from petty business as well as agriculture (which is her secondary activity). From this time onwards, she was also acted as DWACRA leader, secretary member and now as chairmen to watersheds committee (women's). Though she was the chairman of the committee but financial powers are with Sakranna Goud, who was chairmen of the completed watershed programme in the village.

She said that if good crops means farmers would have spent much more on vegetables and buy new things. If no crops in the season, their petty business would also be very dull. Because of the droughts, they have to go to moneylenders for debt, which made them dependent and ultimately indebted ness as she narrated about the villagers.

She said that her husband was committed suicide 10 years back, due to the allegations made by villagers against him. The reason is that in beerapua temple, which is situated in village, some body has stolen the jewellery items, and the villagers were suspicious about vannappa (Lingammas husband) and his sister's husband. She also said that her husband was sensitive, sincere, jovajal man. His sincerity made him to commit suicide as said by Lingamma. She was also narrated that, whoever (officials) comes to the village, they are not leaving the village with out meeting Lingammas husband. He was a famous petty businessman said by lingamma. She was also reminded that, when her husband was alive, she had not gone out of the village for any work. She was not aware of anything at that time. After her husband's death, she had faced lot of problems and realized that her children should not suffer the same and decided to send them to school.

Future Livelihood Strategy:- She said that she is already to face the problems and should manage the affairs to achieve the sustainable living.

Lingamma has said that, now she is participating in all the developmental activities of the village and also attending all the Janmabhoomi and DWACRA meetings and able to speak/ talk with officials with out any hesitation or fear/shy. She said because of the DWACRA, now she is able to improve her livelihoods and also aware about all the developmental programmes.

Role of DWCRA in the Women's Empowerment:-

According to the members and two leaders of the groups who were, attended the PRA meeting, there are 9 groups in Mallapuram. They also said that approximately 80% of the people are covered in this programme. Some of the BCs (i.e., Kurubas) were not involved in the DWACRA groups. Women out rightly says that before the introduction of the DWACRA schemes in the village, they are not aware of outside activities of the village except domestic and agricultural activities.

Because of the DWACRA programme, they (women) have a role in Household decision making process, aware of cleanliness of surroundings and they are also contributing to school building construction etc. Women members also said that their husbands are allowing them to attend the meeting and whenever teacher is not coming to school, they are giving complaints to higher officials. They also revealed that, now they are able to talk with officials with out any hesitation and we are demanding them about our benefits/ programme or schemes etc.

Some women faced problems while receiving the benefits by means of running around the officials and offices for sanctioning of grants and other funds. Women have complained that Sarpanch is delaying for sanctioning of funds by means of not signing the form.

Present Women member who were attended the meeting have told that there are 9 self help groups in the village. Because of these groups women felt that they were able to go outside of the village to participate in the discussions with officials, banks etc. and they have a role in decision-making process in the household's activities. They also said that their husbands now believed that women are also could become the bread earner of the family. They are giving importance to their children education and increase of thriftiness as said by the informant. For example, Lingamma (B.C Kuruba) newly elected chairperson of the women water shed run by RDT (PIA), said that she is aware of all the programmes and used to attend all the meetings creating awareness about education (including children education) and representing problems to the officials.

Five years back:- Old Women has narrated that one official visited the village and met 6. C.Nagaraju CBT Obulapuram old women and informed them about savings and also availability of the loans. Later few women members divided to start the groups, like wise two groups have been formed. They felt that only 30% of them (women) were aware of the groups/ programmes at that time.

Women members were felt that, they were not aware of any programmes, schemes, meetings etc. but one old women by name Savitri, DWACRA Group members replied that there are several programmes, policies and schemes during Indiria Gandhi period, for upliftment of poor. But there was not much focused or advertised, like as of now.

10 years back:- According to the Lingamma, there are no groups or SHGs at that time. Women are not aware of the any benefits or programmes, which are meant to their development. She has said that due to RDT, some people in the village are aware of these outside activities and people are interested to form groups. She has narrated that roughly 10% of women are aware of the outside activities of the village.

15 years back:- Majority of the women felt that, their knowledge is nil except to hear their mother in-law and go for agricultural operations

Reasons for awareness:

Women felt that, they got awareness about their lives due to the initiatives of Government and Non-government agencies. More so because of the efforts initiated in the region by the Rural Development Trust, an NGO, working in the area for the last 25 years. They also felt that charismatic leaders like Indira Gandhi, they came to know about politics and local level politics.

IV- POSITIVE IMPACT THROUGH WATERSHEDS PROGRAMME:-

People felt that before watershed programme their lands were not in good condition. Everywhere they could found stones, rocks etc. Farmers felt that their yielding also reduced drastically. Labourers were unable to get the wage works, so they used to migrate to other areas for works. Irrigated area acreage was less before watershed programme in the Mallapuram. Dairying people have felt that their milk yield also very less before the watersheds in Mallapuram. Farmers used to go to distant places for grazing purposes. People felt that after watershed programme, bunding works have done in the lands. By which both farmers and labourers were benefited by means of getting more number of wage works to labourers and soil rejuvenation has increased which resulted in the crop yielding to the farmers.

Horticultural crops have been given to the farmers through which changes have come in the cropping pattern. Due to the watershed programme, ground water table has increased to 110 feets from 80 feets according to the sarpanch. According to Venkatesu, who is practicing Dairying, milk yield has improved drastically from 60 litres to 300 litres over a period of three years. People have also felt that forestland has increased. According to the farmer by name Ramanjaneyulu, crop yield has gone up from 5 to 6 bags per acre to 8 to 10 bags after watershed programme.

Non –form activity has also increased after watershed programme in the village. There are 3 hotels, 3 petty business shops in the village which were not there before watershed programme. Some of the people have maintaining autos and running between Mallapuram to Kalyanadurg. They said that due to watershed programme, self employment has been improved according to Chandrasekhar.

Wage rates have increased compared to other areas as said by the Sakranna Goud Ex. Watershed chairman. Due to the equal wage rates system followed in the watershed programme, women labourers felt happy and agricultural labour rates have also increased according to Hanumappa.

Due to watershed programme, women’s position has improved and savings has increased drastically. Lingamma, who is the chairman of the watershed committee, has said that watershed programme has brought changes in their livelihoods systems. Thus, it is seen from the study that watershed development programme has immensely changed the lives of the marginal communities in the drought regions of the Andhra Pradesh.

REFERENCES:

1. Carney, D. (ed.) (1998), Sustainable Rural Livelihoods: What Contributions Can We Make? London: Department for International Development.
2. Chambers, R. (1988), 'Sustainable Livelihoods, environment and development: Putting Poor People first'**, IDS Discussion Paper No.20**, Brighton: Institute of Development Studies at the University of Sussex.
3. Chambers R, Conway GR (1992), Sustainable rural livelihoods: practical concepts for the 21st century. Institute of Development studies: Discussion Paper 296.
4. Government of Andhra Pradesh (1999), 'Andhra Pradesh Rural Livelihood Project Report', Rural Development Department, Hyderabad, A.P.
5. Government of Andhra Pradesh (2000), 'Watershed Development Project Report', Rural Development Department, Hyderabad, A.P.
6. Scoones, I. (1998), Sustainable Rural Livelihoods: A Framework for Analysis. IDS Working Paper No.72. Brighton: Institute of Development Studies at the University of Sussex.

INVESTIGATION OF PROBLEMS AND DIFFICULTIES OF OPERATION AND MAINTENANCE MANAGEMENT'S TRANSFER OF QAZVIN IRRIGATION AND DRAINAGE NETWORKS

Amir Moradinejad[1]

ABSTRACT

Iran is located on the dry belt of the world and precipitation rate is low equal to 1/3 of world average. Time and place distribution of precipitation is inappropriate. Hence water shortage is one of the major problems in the arid region of Iran. Since agriculture sector consumes over %90 of harvested water. Unfortunately due to inadequate system for operation and maintenance of water structure, use optimization and lack of water user's participation in operation management of drainage and irrigation large projects, and transferring management of some of irrigation networks to water user's without a studied comprehensive program leads to decrease irrigation efficiency and product, decaying water structures, confusing water user's and consequently high rate of wasting water. In this paper, problems faced in operation management for water and maintenance of water structure in QAZVIN plain having modern irrigation networks have been analyzed. Since operation and maintenance management of hydraulic structures in QAZVIN plain have been governmental and dominant insight on design construction and operation of irrigation networks was initially physical development performance evaluation, users and farmers participation in network management have not been considered. There have been numerous problems for user's and resources. Operation management for water and hydraulic structure has been donated to water user association (W.U.A) under governmental supervision since last year. In this paper we are trying to review and present advantages and disadvantages and also problems and deficiencies in transferring authorities, approaches recommendations through field visit and polling among farmers (W.U.A). by participation irrigation management (P.I.M) for this irrigation network there are some issues such as simplification of administrable affairs reducing governmental involvement time saving, local management decreasing of water loss during transfer and distribution. problems such as, decaying and damaging networks, lack of proper cultivation pattern, inequity in water distribution by water operation in collecting water fee no proper relation among farmers and (W.U.A) among farmers and governmental organization, irrigation efficiency, lack of required motives in order to decrease users expanses, not implementing promotion and training programs which have been studied.

Keyword: W.U.A, QAZVIN irrigation network, irrigation management, operation system.

1- E-mail: jalal_246@yahoo.com TEL: 09188630923

INTRODUCTION

The transference of management in the country has fared based on resolving a temporary problem following foreign patterns and satisfaction of World Bank's facilities condition and is not hosed on precise strategy or program. Hence establishment of operation companies, privatizing activities, legal aspects and readings surveying could not prepare breeding grounds management transference. Also there are limit and temporary success in the above experiences; the aforementioned reasons and lack of suitable approach in programming and mistake in recognition of aspects have fettered the formation of management transference of Qazvin irrigation network.

Government and semi-governmental management in the 30 year-old project (Irrigation and drainage of 60.000 hectares of Qazvin plain) resulted in served problems and poverty in 1200Km constructions such as primary, secondary, tertiary and fourth channels with 94.220.320 and 560 Km respectively and in more than 3000 Hydro mechanical machinery and 30.000 farmers. Traditional and in correct operation and law irrigation efficiency (33%) are the issues of this kind of management for the above mentioned farmers and beneficiaries.

Viewpoints and derivations:

1) The country's long-term development program.
2) The third development program law.
3) Provision two of clause 106, establishment of local water management. Clause 5 of executive bylaw, article (T) of provision (19) of second development program.
4) Action plan for clause 107.
5) Approach of World Bank (1999).

Since 1999 the World Bank began a new approach for poverty eradicate and in per suit of effectiveness improvement, it made balance among macroeconomic, Conditions, construction aspects and human and phenomenal development.

This frame depends in 4 related principles:

1) Existence of comprehend save and long-term development ideal.
2) Complete inclusion of country's development guidelines in participation and comprehensiveness.
3) Increase of participation and coordination among beneficiaries groups.
4) Being account in all stages with control and measurement.

The trend of O&M management irrigation and drainage networks before association's establishment:

Agricultural water operation system and delivery water to the farmers in the modern Qazvin plan irrigation and drainage network is done by determination of each farmer's share according to arable program and required crop water.

Indeed water users, after conclusion, request subtotal or their entire monthly shares individually. This request along with price bank bill is delivered to the sales person then he or she after required controlling reports the result to the distributor custodian, and this person sort the above mentioned do comments according to the secondary channel and delivers water to the farmers through the gates. Arable program of those farmers who are in the same area is alike and the representative of these farmers is responsible to get their water share form energy ministry's operating companies, which are responsible for network operations, and then distribute water between third and 4th channels.

Water is delivered to the farmer's representative in the third channel gates, and distribution of it in the 4th channel is of representative responsibilities but in the farm by them selves. The farmers don’t accept any responsibilities in subsidiary channel's O&M and the government administrations don’t move on this matter which is resulted in following problems:

1) Undesirable project O&M and bench premature destruction.
2) The water installations such as checks and outlet works are out of order.
3) Installation of several illegal gates and irregular outlet works in farms.
4) Imperfect artificial recharge of project area through modern Qazvin network.
5) Unexampled spread digging illegal wells and in crease discharge rate of legal wells.
6) Exploitation of water more than aquifer layer capacity and hence drops of water table level.
7) Increase dangerous points due to spread of habitations near network and lack of comprehensive strategy for immunization hence falling of people or cars in to channels.

To face and unravel the above mentioned problems, the government on behalf of (clause (T) of provision (19) and it's executive bylaw, clause 106 and 107 of third program, clause (A) & (8) and clause (17) of 4th program) charge the energy and jihad-e-agriculture ministries to improve and optimize agriculture water consumption and gravitate beneficiaries to volumetric delivery of water (based on the exist document), to equip suitable measuring instruments and transferring of (water installations) o & m responsibilities to the water user associations.

Transference of management to the associations:

Qazvin plain irrigation management transfer (IMT) formulated in 2002 with the aim of substantial conservation and maintenance and operation optimization.

The design of local water management system was fared according to arable blocks and assortment of neighboring farmers till to third channels sluice points.

Water user associations syndicates was established according to integration of irrigation associations bounds to secondary channels this design implemented by using of local and regional capacities since 2002 in form of three year schedule.

With three stays as follows:

1) Internal stage: system design, planning, data base collection and processing, cooling of cultivate and irrigation information and preparing a schedule for design and time of implementation.
2) Regional stage: determination of farmer group's represents datives, water supply conclusions, operation of arable blocks and assortment of participant's information and concerned priorities.
3) National and headquarters stage: Initiation of syndicates and regulation of agreement for taking main and distribution channels and also provision transfer of operating company's share to the water users.

During (2004-2005) arable year, the third and final stage of the Qazvin plan (IMT) design implemented with administration, financial and operational delegation and the following activates are fared by syndicates chairman without government interference.

a) Register of order, sale, distribute and agriculture water delivery.
b) Dredging of channels, reconstruction of network installations.
c) Volumetric delivery of water to the syndicate's chair man in man channel outlet points.
d) Continuous overhaul of installations and report of water user's offends.
e) Accountability and resolve of water user's request and problems in the syndicate office.

At the moment by implementing step by of PIM and provision of water user's short term benefits, their gratifications have increased. This kind of influence on behalf of arresting farmer's attention and cooperation for transfer of the government's rest duty to them is very important.

Also with complete and systematic coordination with to syndicates representative that have been selected among 3000 person and applying supplementary plans, land consolidations it is expected that gradually raising effectiveness, real and justly distribution of water and irrigation efficiency will materialized.

Duties and entrust of charges to the water users:

1) Acceptance and register of water demands or water trade requests form network participators.
2) Accord of demands with water supply conclusions and ration according to cultivate and irrigation plan.
3) Planning and accordance for selling water and getting water rate and taking turn for water delivery.
4) Operating and administration of water distribution affairs (about 1100 km) and the network's channels (2,3,4)

5) Volumetric delivery of water to water users association's representatives due to arable units.
6) To lead the administrative affairs and supervision to associations and group's operation (3, 4 channels).
7) Continuous visit and inspection of installations and prepare and sending of farmer's offends.
8) Accountability and resolving of farmer's problem in the water user syndicate's office.

At the moment there are 158 associations, 10 syndicates and am active central focal and O&M management with 30.000 farmers. The syndicate has started its activities since 2003 and each office is responsible for comprehensive water management of an area and every association is like representative of a gate only the farmer's representative refer to the association's office to deliver water and proceed by it's identity card.

"Impacts of irrigation management transference to water users:

Placement of 3000 farmers terms and clientele with to syndicate's chair man is it's most important effect.

Cumulative effects	Reducer effects
People supervision	Official bureaucracy
Gustily water distribution	Terms and clientele
Substantial maintenance	Government tenure
Irrigation efficiency	Production costs
Increase of productivity	Reduce of costs

Pursuant to the accomplished activities on behalf of beneficiaries, operation company Jihad-e-agriculture organization and Qazvin water affairs aren't successful of irrigation management transference and there are some dysfunctions and if we unravel the following problems, of course by applying some adaptabilities, we cam develop it to whole country as a pattern project.

Existing problems:

1) There is not confident water source.
2) Nonintervention of beneficiaries' ideas or opinion or polls both at study and implementation stages.
3) Nonexistence of initial social studies in order to determine suitable o&m management capacity building with farmer's participation.
4) Absence or lock of suitable laws.

5) Destruction of network and hydro mechanical equipments and poverty of water transition, distribution and farmer's water share division.
6) Neglect of comprehend save and continuous tramping program for agriculture water users.
7) Nonexistence of annual supervision for implementation of cultivate plan.
8) There aren't suitable equipments for volumetric delivery of water in third and 4th channels.
9) Tamper of some beneficiaries on behalf of persons who are responsible for water division in the network area and in water division and distribution.
10) The government doesn't support the existing associations.
11) Uncertain in comes and costs.
12) Uncertain administrative terms among associations and governmental sections.

REFERENCE:

1) Hydarian, A (1383) an analytical review on native experiences about irrigation management transfer. First session for evolution of drainage and irrigation network problems.
2) Ghacemi, A. (1383) plan for irrigation ferries monument Transfer a report by regional water organization of Tehran.
3) Guide book on participatory irrigation management www.worldbank.org Worldbank. (1998)
4) Meinen- Dick, r 1997. Farmer participation in irrigation: 20 years of experience.

SOME LEARNING FROM IRRIGATION PARTICIPATORY MANAGEMENT IN QANATS

Barahimi Mohsen[1], Mehrabian Hamid[2]. R, Rezaeenejad Ali[3]

ABSTRACT

Water is a valuable and vital element especially in arid and semi arid region of Iran. Due to scarcity of this substantial elements in most part of Iran there are water distribution systems established for rightful use of water. these systems have been formed according to users demand climatic condition current water supplies arable lands area and water distribution methods. Water distribution system is an institution which has been formed and created during evolution of agricultural societies gradually and preexist issue of social and economical of arid and semi arid regions residents.

In arid region of Iran water distribution systems have fundamental similarities but there also are some distinctions which lead to study these systems individually. It is worth to say that operational system of Qanats has long history without any governmental or institutional support and are active yet.

I this research we make an effort to evaluate and investigate operational system for Qanats to introduce their power points to other sectors as a recommendation especially for water user association establishment.

Agents such as type of operation systems organizational mechanism water measurement unit water division circuit and etc would be evaluated and finally beneficial suggestions and recommendation for this research and water association establishing (especially for surface water) would be presented.

Keywords: *Qanat, water, water division, water user association*

INTRODUCTION: QANATS HISTORY AND BACKGROUND IN IRAN

Since human kind dominated over his environment and captured natural forces in somehow, changed his migratory life style and chose a permanent habitat. By doing this, need to food production and consequently agronomy and agricultural promotion

1- Head of Qanat group, Water Resource Management and Consumption Optimization Office, 7th Kilometer Mardabad Road, P.O. BOX: 11895-4413, Karaj, Iran
2- Geology expert, Water Resource Management and Consumption Optimization Office, 7th Kilometer Mardabad Road, P.O. BOX: 11895-4413, Karaj, Iran
3- Water supply expert, Jihad agriculture organization of Kerman province, Kerman, Iran

became obvious. In this stage, agriculture and farming became as a permanent and especial job and occupation and as a main requirement for human kind. Although artificial water harvesting systems met human needs but did not provide sufficient and permanent water supply. On the other hand, traditional water conveyance system created many problems due to long distance, high rate evaporation and sever sedimentation through canals leaded to innovate a system known as Qanat, to overcome those mentioned problems.

Undoubtedly, Qanat`s emergence goes back to third millennium B.C and initiation and development of elementary sciences. In the other word development of knowledge about surface features of the earth and sloping of Qanat gallery, and also improvement of tool science near human although simple and elementary could be known considered as the main reason for innovation of Qanat.

Qanats are one of the most ancient ground water harvesting methods which convey water through canals without any particular energy consumption except gravity and minimum evaporation rate. According to some historians, Qanat technology refers back to 6000 years before which are documented in Herodotus literature.

Unsteady and improper harvesting of groundwater and illegal well digging in recharging zone of Qanats has resulted dramatic decreasing water table in wet part of Qanats. Increasing cost of maintenance and amendment along with ignoring Qanats practitioners in relation to their livelihood and most of all, indifference of previous royal government toward Qanat due to effort for being dependant to western technology, leaded to gradual decline of Qanats. By competition between traditional and modern technology this ancient method failed against modern harvesting one. By Islamic revolution triumph in Iran, general policies of Islamic government oriented toward independence for agricultural crops and followed by considering traditional and original irrigation and water harvesting methods. According to above mentioned subjects, maintenance of Qanat became the main goal and also significant efforts were performed by official authorities. Nowadays there are more than 32770 live (active) Qanat which irrigate about 1065053 Ha of cultivation lands.

1. WHAT IS QANAT?

Apparently, Qanats are suggested by natural springs to Iranians as an initial vital element for residents of this plateau. The word “KARIZ” or Qanat has a similar concept and meaning in all Persian dictionaries. A pithy definition could be fund in “Borhane Ghate” encyclopedia as:

“An underground canal for flowing water inside”. The main reason for develop of Qanat over Iran’s plateau are various but the most important one is various climatologic conditions in this plateau. Practically, this method for water harvesting has become innovated according to particular climatic condition of Iran especially in arid and semiarid region and then has been utilized for other similar area.

2. QANAT STRUCTURE

A typical Qanat has 6 main parts including boreholes, shafts, mother well, gallery, outlet and open canal. The most inexpensive and simple way for constructing a Qanat is digging a horizontal canal (gallery) from outlet toward aquifer continuously. This horizontal canal must be constructed with a very slight slope to allow water flow due to gravity.

Initially, two adjacent shafts are dug then start to connect bottom of these wells to each other by digging a gallery from downstream well to upstream one. Similarly, it progress continuously from outlet toward dry part of subsurface layers and subsequently in wet part of aquifer (under water table) and result to flow water inside gallery.

3. REASONS FOR CONSTRUCTING QANAT IN IRAN

The main reasons of Qanat`s innovation by Iranian could be as followed:

- Necessity for water supply from groundwater in arid region (improper distribution of precipitation in Iran)
- Agriculture and livelihood support (potable and agricultural water)
- Conveyance of water without energy consumption
- Annual operation
- Good compatibility with various region from climatic point of view

4. BENEFITS OF QANAT

Although, more than 5000 years have been elapsed of Qanat innovation in Iran, nevertheless this remarkable technology is stable and useful. Main reasons are as below:

- No need to continuous maintenance
- Generating participation sense and concept for maintenance and operation among water users
- Existence of Qanat practitioners for maintenance and operation
- Groundwater harvesting in various region
- Entrepreneurship
- Environment friendly
- Introduction of Qanat as a reliable asset (godsend)
- Not harmful for ground water balance

It must be noted that of above mentioned subjects, water user associations established for Qanat are a significant and sustainable system and have protect Qanats during several thousand years.

5. OWNERSHIP AND WATER USING SYSTEM FOR QANATS

Water is a precious and vital substance in arid region of Iran, since water is not abundant, so water user systems have been established for rightful using of water. These systems have been formed according to requirements of residents, climatic conditions, available water resources and etc.

Water distribution systems have been formed gradually during evolution of agricultural societies and are issues of behavior of residents in arid regions. At these part of Iran, water distribution system have basic similarities but have also some distinctions which compel us to consider them separately.

6. WATER DIVISION METHOD AND ESTIMATION CRITERIA

In the past, number of owners was not high, and water distribution has been done by them. Land reforms and inheritance resulted to increase of owner numbers and consequently complexity of water division. Notwithstanding problems, some trustees have undertaken supervising the water division as “Divider “and do it based on the share proportion. All of harvested water is divided among farmers. Time unit is applied for division, that is, allocated water to each farmer is considered as the time of flowing water in the furrows of farmer’s land which today is calculated by clock (chronometer). In the past there was a kind of water clock used for this propose. Before expansion of deep well, maintenance of Qanat had been assigned to the owners. At that time there were 4 types of ownership for Qanats including private, crofters or little owner, public or governmental and charity and all of these owners know themselves liable to maintain and protect Qanat. Some people know about their own Qanat from several points of view and did various repairments. Specialized repairments have been done by construction experts under supervising of owners. Those Qanat which had several crafter (owner), were faced with some problems in repairments. In recent years, government has allocated gratuitous credits and long-term loans for all maintenance activities related to Qanat particularly for poor owners so that they are able to cope with the problems relevant to Qanats. In Bam region, maintenance and operation of Qanats have been managed by governmental credits and owners support by owner representation or Islamic council of village. Usually any Qanat have had a native and permanent practitioner for maintaining for a long time.

Tourists and explorers and also scientists passing through Tabas, considered it as paradise of desert, due to vegetation and orchards of the region during four seasons. By traveling about 400 Km through desert lands. One could see merely Tabas orchards which makes palatial scenery. In order to optimize utilization water resources in Tabas region which are mainly focused on Qanats, there are several agreements in which, the best one is the Scroll of Sheikh Bah o din Ameli, prepared based on request of local governor.

So in order to arrange water circulation under supervision of local practitioners, owners and drinkers approved following regulations and guaranteed proper implementation. After earthquake in September 1979 ,there was a conflict in water cycle of Tabas streams, resulted in extending rotation from 9 to 18 day leaded to drying out of orchards and loss for farmers. Therefore in order to dissolve current deficiencies and correct implementation of regulations as before earthquake .It was prepared and approved a status book to be basic for correct performance.

7. WATER COUNCIL’S STATUS BOOK FOR QANAT OF TABAS STREAMS

This status book consists of several sections as followed:

A. **Configuration**: utilization of Tabas streams water would be under supervision of water council which consists of representatives from governorship, municipally, Agriculture, 6 of owners and farmers per stream, 3 persons elected by owners and drinkers for 2 years.

B. **Task of council:** Duties of so called council are as below:

- Communication with officials
- Leaving offenders to the court and laying claim for it if required
- Inquiry about drinkers complaint and untying them
- Determining water fee yearly

C. **Author (Sartagh) selection and his duties:** Author is in charge of all about accounting of water and is elected by water council. Author has to record and register all stockholders and also is director of irrigation cooperation with following tasks:

- In charge of implementation of Irrigation Scroll
- Author will be elected by owners and drinkers
- Author has to determine and introduce literate, expert and qualified Taghdar`s to water council to be confirmed
- Taghdars must introduce a honest KAIAL (measure man)
- Author has to present the list of drinkers enclosed in Scroll including ownership or rental before 8 of March.
- Request of police to assist Taghdars through governorship

D. **Water distribution system of streams:**

- Initiation of first circulation (circuit) would be 13 days before of new year and end of summer circulation would be 9 of October which is divided to 21 turns for drinkers
- Taghsdars have to control water delivery circulation (sequence) according to a registration notebook (Pagir) submitted by author .It is divided to 3 winter circuits, each 2 turns, totally 6 turns and 5 summer circuits, each 3 turns and totally 15 turns, and 2 planting circuits, 8 days per circuits, totally 15 circuits in 25 turns for water delivery.
- Annual salary for Taghdars and Kaials would be provided through water circulation determined by water council.
- Taghdars have to consider precise water circulation, undertake all responsibilities.

- All of owners and drinkers have to consume half of their registered water share at first circulation otherwise it will be sold to other customer if any, and deliver the received money to the owner of water share .if there was not any demand it would be lost and no protest would be accepted
- Author has to hold a meeting to investigate and control paid expenditures before last 3 days of any circuits.
- Water council should register a bank account number and deposit all received incomes in. Issued cheque are signed by authors constantly and either water council director or accountant to be payable
- Taghdars have to submit their water consumption bill to measure man each day and control to ensure not extra-irrigation
- Drinkers and holders should submit their water draft to author by the February 24 ultimately. Otherwise by ending first turn, water draft would be assigned half share.

This constitution was provided in 4 sections and confirmed by meeting participants. Water council is also in charge of monitoring on proper implementation maintenance and renovation of Qanats.

8. WATER DIVISION AND OWNERSHIP FOR GOHARRIZE JOOPAR QANAT IN KERMAN PROVINCE:

As mentioned before, since water is a precious and vital element in arid region, in order to rightful use and consumption of water, there have been established water distribution systems which are similar in some way in different regions and have been improved gradually together with agricultural society. Goharriz Qanat has been divided to 12000 shares which were separated by a 6 part divider as below:

- **Tribute division**: name comes from arrogated water share by some people of Joopar when Mrs. Gohar which renovates and rehabilitated the Qanat after it was dried. It is equal to 925 parts
- **Official part (1 and 2)**: whit regard to collected tax paid by farmers through government, therefore 4333 parts of water was allocated to government as tax. Nowadays it has been sold by government after establishment of registration organization.
- **Molla (teacher) part**: In ancient time which there were not any classic and modern education system (schools and etc), children were educated by a literate person who usually was a priest (Molla) and hence he or she was allocated a share of Qanat water equal to 6500 part for livelihood.
- **Arbab (land lord) part**: It is equal to 5160 of total shares belong to those people who reconstruct and maintained Qanat.

9. **CONCLUSION**

With regard to investigations on traditional current operation systems for Qanats in several provinces of Iran, following subject are to be mentioned:

- All of active Qanats of Iran has their own unique operation system
- Operation system of each Qanats is different from others with regard to climatic, socio-economic, and cultural conditions. In the other word, dominant condition would influence the operation system and must be considered.
- Qanats` operation systems have been developed by people based on their pleasure not by obligation.
- Although there is no documents for current operation systems, all details and rules have been transferred orally from past to present, in order to maintain and protect these systems it is required develop a documentation system.
- All needs involved to Qanat and operations have been predicted in operation systems with regard to Qanat discharge rate.
- Generally, people responsible for operation system are elected from native and trustee owners and drinkers which results in less conflict among beneficiaries.
- It is recommended to replace water user cooperation with water operation systems, in which must try to dissolve all deficiencies while keep all fundamental issues.
- Applying obtained experiences through traditional operation systems is of great importance to improve skills of involved people and promote them to establish new cooperation and systems.
- Climatic, social, economic and cultural condition must be considered and apply experiences with regard to distribution and expansion of Qanats through out the country

REFERENCES:

1. Reports prepared by Qanat and historical hydraulic structures group; water resources development office
2. Presented articles in International conference on Qanat; Shahid bahonar University; Kerman-1384 (2005)
3. Reports on Qanat of Tabas-Jihad-E-agriculture organization of South Khorasan province
4. Reports on Qanat of Joopar – Land & Water management-Jihad-E-agriculture organization of Kerman province.

PARTICIPATORY APPROACH TO CROSS-DISCIPLINARY WATER RESEARCH: INTRODUCING (HELP) INITIATIVE AND AUSTRALIAN PERSPECTIVE

Shahbaz Khan[1]; Zahra Paydar[2]

ABSTRACT

Internationally there is a major lag between research, and real world water policy and management. Most water management policy is based on outdated knowledge and technology. Hydrology for Environment, Life and Policy (HELP) is a joint initiative of the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the World Meteorological Organization (WMO). UNESCO HELP initiative is aimed to bridge the gap between water policy, water resources management and scientific communities from the setting of research agenda to the free flow of information to be used in the day to day management and policy making processes. HELP is creating a new approach to integrated catchment management through the creation of a framework for water law and policy experts, water resource managers and water scientists to work together on water-related problems.

The broad objectives of HELP are to strengthen field-oriented experimental hydrology using drainage basins with scales ranging from 10^4 to 10^6 km^2 as the framework. Water related physical (hydrological, climatological, ecological) and non-physical (technical, sociological, economics, administrative, law) observations will be made in these catchments which address the most critical policy and management issues as perceived by “users” under different biophysical and socio-economic environments, taking into account the needs for sustainable development. The desire for this new programme to be truly “user-driven” will require the active involvement of research, university teaching, policy-making and facilitating (water and land resource managers groups) to set the policy agenda and ensure the scientific results will benefit societal needs through the revision of policy and management practices.

In Australia, the multilevel stakeholder engagement in urban and rural water research and development of management tools and policies in the Murrumbidgee catchment had helped it gain the status of reference catchment under the (HELP) programme.The

1 - Regional Coordinator, UNESCO IHP-HELP, Professor of Hydrology, Charles Sturt University & CSIRO Land and Water , Locked Bag 588, Wagga Wagga 2678, Australia, Phone: +61-2-6933 2927 Fax: +61-2-6933 2647 Email: skhan@csu.edu.au
2 - CSIRO Land and Water, GPO Box 1666 Canberra, Australia, Email: Zahra.Paydar@csiro.au

competing water uses and environmental and economic concerns in the Murrumbidgee are typical of other arid catchments in the world. Both completed and ongoing hydrological projects are available that can be used to illustrate how communities, researchers and regulation bodies are involved in catchment management by developing appropriate geographic information system, irrigation management tools, hydrologic–economic and educational models. The approach has been very influential in bringing about change in land and water management and in informing and guiding regional policy.

Keywords: Hydrology, HELP, UNESCO, Participatory Water Management research, Catchment, Irrigation Management in Australia

1. INTRODUCTION

Gibbons et al. [1] distinguishes two approaches to knowledge production: traditional research is Mode 1, in which there are narrow fields of study and separate roles, with academics developing the knowledge and passing it on to the practitioners. In Mode 2, knowledge is produced by a transdisciplinary team that includes the practitioner, and the learning is immediate for all--it is part of the discovery process. The role of the practitioner is central to Mode 2 throughout the entire research process. The HELP initiative is encouraging Mode 2 knowledge production. HELP is a joint initiative of the United Nations Educational Scientific and Cultural Organisation (UNESCO) and the World Meteorological Organisation (WMO). HELP began following the 5th UNESCO/WMO International Conference on Hydrology in February 1999 and is led by the International Hydrology Program. HELP aims to address key water resource issues in the field and integrate them with policy and management needs therefore introducing a new approach to integrated catchment management. The new approach is to use real catchments, with real water related problems as the environment within which hydrological scientists, water resources managers and water law and policy experts can work together.

HELP is founded on a global network of catchments as shown in Figure 1. National or local authorities can suggest catchments to be included, which will need to fulfil the HELP criteria for baseline physical and socio-economic data exchange. A new catchment must also have adequate local capacity to increase sharing of expertise, to improve access to data and the findings from other HELP catchments, and to provide opportunities for funding and building capacity in water institutions.

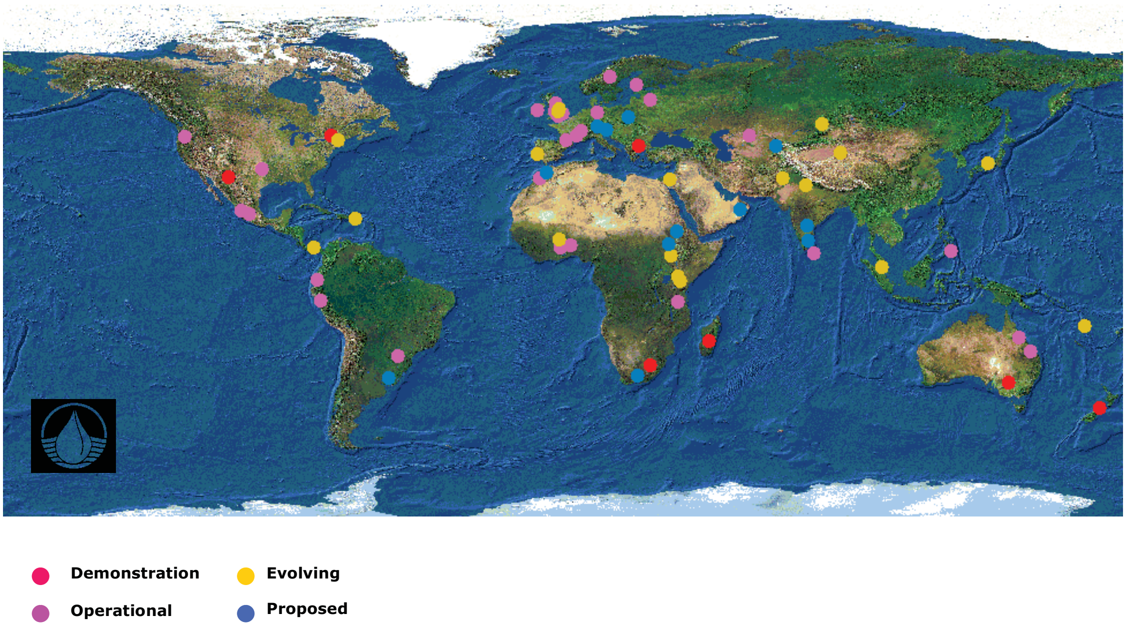


Figure1- Current UNESCO HELP Basins

The Demonstration and Operational basins each have several years of practical experience of working within the HELP framework. In some cases longstanding scientific programmes have been developing further through the application of sustainability and good governance practices. The HELP initiative provides them with international recognition of progress achieved in this new direction. The high proportion of Operational basins in Europe is a result of developments in the European Union. Many of these projects have benefited from EU funding, or national funding linked to EU legislation. Most projects in the South are linked to local recognition that water problems are best approached through Integrated Water Resources Management (IWRM). Further information about individual HELP basins can be found at www.unesco.org/water/ihp/help.

In the Murrumbidgee catchment, south-eastern Australia, a cooperative and practical approach by irrigation farmers, industry and researchers has been delivering research to address regional needs. This has lead to Murrumbidgeee gaining demonstration basin status within the HELP network. In the Murrumbidgee basin to bring about more effective management of the catchment, communities, researchers and regulation bodies are involved in developing a range of tools, including appropriate geographic information system databases and irrigation tools, hydrologic–economic and educational models. Management of water resources in the region requires a rigorous understanding and application of hydrology combined with economic, policy and legal aspects of water management.

2. HELP ACTION AREAS

HELP is designed to develop scientific research in the application of integrated water resources management (IWRM) through Hydrology for Environment, Life and Policy [2]. Examples of HELP success in active involvement of university teaching, policy-making and facilitating (water and land resource managers groups) to set the policy agenda and ensure the scientific results will benefit societal needs through the revision of policy and management practices in Australia are given by Khan [3].

HELP has currently six major action areas for promotion of Mode 2 science as described below.

2.1 WATER AND CLIMATE

The major research question into water and climate area is: "How can knowledge, understanding, and predictive modelling of the influence of global variability and change on hydrological variables and remotely sensed data can be used to improve the management and design of water resource, agro-hydrological and eco-hydrological systems?"

Subsidiary issues for this interest area include:

- How significant is the relationship between the statistics of hydrological variables and observable global phenomena, and how does this change with location?
- How can remote data capture, and advanced information transfer technologies best be applied to improve the management and design of water systems?
- How can predictions of seasonal-to-interannual variations be used to improve the management of water, including for disaster prevention (floods and droughts)?
- How significant are multi-decadal fluctuations in climate, and how can knowledge of such fluctuations be used to improve the design of water systems?
- What is the hydrological significance of potential anthropogenic climate change, and how can predictions of such change best be used to improve design of water systems?

2.2 WATER AND THE ENVIRONMENT

The level of environmental protection to be provided in any basin is a matter of political choice and commitment. Developing countries will usually be least able or willing to consider the issue of the water required for environmental protection – their first priority usually is to take care of the immediate, basic needs of their population. This HELP initiative is aimed to raise the awareness so that these two objectives are not contradictory and there are pathways to strike a balance. Major issues include the potential impacts on the environment of:

- population growth
- industrialisation and pollution
- land cover/land-use changes
- species extinction and introduction of new species perceptions and attitudes of society towards the environment

HELP research questions include:

- What role does the environment play in securing water resources?
- How do we place a value on the “natural” environment?
- How can we identify the impacts of environmental change on water resources?
- How do we minimise conflicting environmental and human requirements?
- What is the effectiveness of environmental law on water resources?

2.3 WATER QUALITY AND HUMAN HEALTH

This HELP objective aims to develop the necessary integrated view of how catchments work, in order to understand the relations between water quality and water quantity at variable spatial and temporal scales. There is need to understand how water quality is affected by varying land uses and management approaches – that is, to understand the basic evolution of water quality. The understanding of processes linked with contaminant transfer and temporary adsorption (or absorption) through the land system – before these enter into rivers and streams – is extremely poor. HELP aims to promote appropriate water-quality monitoring programmes in its network of basins.

2.4 WATER AND FOOD

The major HELP challenge in terms of water and food is “how can the efficiency with which water is used in agriculture be improved and how do the need, scope and methods for achieving this vary regionally and locally? “

HELP is aiming to facilitate research on some of the following questions:

- the most appropriate techniques for reducing water losses from agricultural fields due to surface runoff, soil evaporation and drainage;
- how much water could be saved by improving transpiration, and what techniques can be used to do this;
- how much water efficiency could be improved by using different crops and/or crop mixtures;

- the relative savings to be made in rain-fed and irrigated agriculture, and potential for the complementary use of water between the two;
- whether significant efficiency gains can be made through assessing the way water can be used in different places and at different times across an entire catchment;
- the downstream impacts of increasing water-use efficiency in agricultural areas;
- the reasons local farmers do not adapt apparently straightforward technologies for improving water-use efficiency.

2.5 WATER AND CONFLICTS

HELP includes a component on the role of hydrological data, information and process understanding in management of water resources, as well as in co-operation on water management and avoidance and resolution of conflicts.

HELP aims to promote development and application of Alternative Dispute Resolution (ADR) techniques to water management through:

- studying the role of hydrological information in creating the basis for rational management of water by a nation and among neighbouring countries;
- encouraging basic studies of conflict management integrated with a research programme that has the necessary databases linked with process hydrology.
- supporting studies of specific cases in selected river basins;
- conducting real-world simulations in support of joint management.

2.6 IMPROVING COMMUNICATIONS

HELP aims to encourage multilevel stakeholder engagement to:

- provide a reduced set of reliable and comparable information on the state of catchments;
- interpret science in a way useful to managers;
- include water resources, environment, social and economic criteria;
- capture the "essence" of the catchment in a few statistics;
- provide comparison between countries and regions;
- indicate trends over time and space;
- measure success (and failure) of catchment management, programmes and policies.
- ensure comparability between projects.

3. AUSTRALIAN HELP PERSPECTIVES

The lower Murrumbidgee catchment in the Murray Darling Basin has been selected as the first global reference basin in the HELP pilot phase and remains a demonstration basin in the operational phase since it provides an excellent example of community involvement in hydrological research and development of integrated catchment management policies using a range of tools. The lower Murrumbidgee Catchment is serving as an example catchment to illustrate water resources management under competing water uses and environmental and economic concerns in an arid zone which are similar to many other catchments in the world.

The Murrumbidgee River (Figure 2) has a catchment area of around 84 000 km2 and a length of 1600 km from its source in the Snowy Mountains to its junctionm with the Murray River. The total surface water resources of Murrumbidgee catchment are made up of average flow downstream of two damd (Burrinjuck and Blowering Dams) of around 4000 MCM. The system includes some major floodplain lakes, e.g. Lake Mejum near Narrandera and Yanga Lake near Balranald.

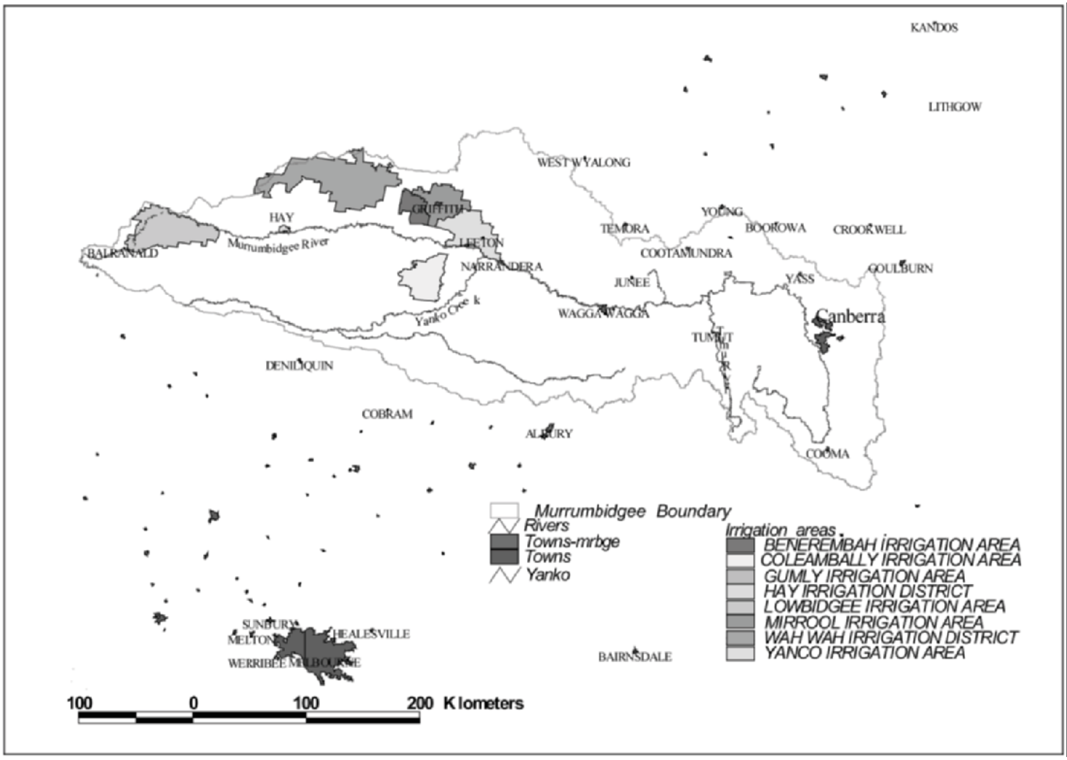


Figure 2. Murrumbidgee catchment and irrigation areas.

The Murrumbidgee catchment can be broadly divided into three major hydrogeological units:

- Upper Murrumbidgee Fractured Aquifers.
- Mid Murrumbidgee Alluvium.
- Lower Murrumbidgee Alluvium.

Downstream of Narrandera, unconsolidated alluvial deposits are collectively known as the Lower Murrumbidgee Alluvium. This alluvial system consists of three major aquifers. The estimated annual recharge to the Lower Murrumbidgee aquifer system is 335 MCM/year and a 'safe yield' is 270 MCM/year [4]. Although the reported groundwater pumping is still less than the 'sustainable yield', there has been a rapid increase in the use of groundwater since 1994/95 with an overall decline in groundwater level of the deeper aquifers between by 10–20 m over the main groundwater pumping area.

Figure 2 shows the location of main irrigation areas (IAs) along the Murrumbidgee River. In addition to these areas, the Lowbidgee is a floodplain area of 150 000 ha with 85 000 ha of irrigated grazing.

The key issues in the Murrumbidgee basin include:

- Water reforms and decline in water availability for irrigation
- Reduced water flows in the river
- Rising watertables and soil salinity in irrigation areas
- Declining pressure levels and contamination of aquifer in groundwater pumping areas
- Competition with downstream use (environmental flows and water quality)
- Increasing salinity in the river
- enhanced climate variability and change
- livelihoods issues

Several landmark changes in water reform policies have been formulated in recent times with the objective of striking a balance between the consumptive and environmental components of flows in Australian catchments. Some of the developments that affect irrigated agriculture include the Council of Australian Governments Reforms and the MDBC CAP on future water development.

These water reforms have had major consequences for irrigated agriculture as they have placed a moratorium on the issue of new surface and groundwater licenses, so further irrigation development is only possible through improving water use efficiency or purchasing water from an existing user. Implementation of the CAP and River Flow Rules has also had the effect of reducing water allocation to irrigators with a history of high use of their allocation. Furthermore, uncertainty of water supply has increased greatly, and it is often not until after the irrigation season is well underway that irrigators have a good estimate of how much water will be available. Thus, there is considerable risk associated with planting and crop establishment decisions.

The threat of cuts in water allocation and recurrence of droughts pose serious problems to the viability of the regional communities in the Murrumbidgee catchment.

Maintaining flows for irrigation is in competition with increasing flows in the river for all downstream users (who are demanding that irrigation allocations be reduced to increase flows and reduce salinity levels in river). Altered and lower flows in the river are key contributors to the decline in river health manifested in ways such as increasing algal blooms, a decline in native fish numbers and increases in exotic species, and a decline of wetlands (due to a lack of water in some instances and permanent inundation of others). There is also concern about groundwater depletion and the risk of contamination of these groundwaters.

Researchers with a range of disciplinary expertise from state and federal government organizations and private organizations, work with regulation agencies and farming communities to develop ways of linking the diverse information bases of the catchment. These groups are also active in promoting learning and management capability of land and water users and technical support people. Within this extended information and learning environment, researchers have developed a set of catchment and farm-level models to assist, assimilate and evaluate better management options. These tools, together with a participatory research and engagement approach, have helped further develop research priorities and management tools. This approach has been very influential in bringing about a change in land and water management and in informing and guiding regional policy that has delivered improved integrated catchment management.

Examples of completed and ongoing hydrological projects addressing some of the above issues are available. These projects are being used to illustrate under the HELP program how communities, researchers and regulation bodies are involved in catchment management by developing appropriate GIS, hydrological, hydrologic economic and educational models. A range of innovative hydrologic, integrated hydrologic economic and community education tools commonly known as SWAGMAN (Salt, WAter and Groundwater MANagement models) [5, 6] have been developed by CSIRO for natural resources management. These models and community participation activities are readily transferable to other parts of the world and can therefore promote technology transfer.

Some of the recently planned HELP related research activities with a strong community involvement include:

a. A framework to assess:

- potential water savings [7] (e.g. from system reticulation losses, channel seepage and on farm losses);
- water saving options [8] piping of flows, channel lining, alternative irrigation/cropping possibilities and
- local and regional economic and environmental benefits of increased water use efficiency at a range of scales

b. Improved understanding of salt and contaminant flows from irrigation areas and their interactions with the regional hydrological system (surface and ground water) [6,9];

c. Determine tradeoffs between on farm productivity objectives and regional ecological and hydrological targets in response to water management practices;

d. Develop tools to help change seasonality of river flows towards natural patterns for better ecological outcomes [10]. This will be achieved by spreading the irrigation demand through the optimum use of in stream, off stream and irrigation area storage facilities and by alternative cropping patterns;

e. A hydrologic economic framework to help inform infrastructure investment and rationalisation decisions for future irrigation systems considering current and future climate scenarios [11];

f. Improved participative research and management methods and tools (web based models, market based instruments and best management guidelines) that engender trust and understanding in the regional communities that would be impacted by such changes.

g. Market based instruments for trading net recharge credits in the Coleambally Irrigation Area

Recent development include Wagga Wagga Global Water Smart Initiative. Wagga Wagga is located in the middle of the Murrumbidgee catchment and has a history of creative water management including effluent reuse and salinity management which places it in prime position to become the urban demonstration city. The idea is to develop a city wide strategy for urban water management that will be complementary to the existing non-urban HELP activities occurring within the Murrumbidgee Basin.

This strategy includes issues such as management of local Lake Albert and the Murrumbidgee River for recreational purposes, smart water use within the urban area, reuse of effluent water, and management of urban groundwater including salinity management. The aim is that within 10 years (by 2015) Wagga Wagga is recognised internationally as a Global Water Smart City. There is great opportunity for other semi-arid cities around the world to share the sustainable water management experience gained under this project.

Stakeholders are involved through the steering committees of the planned and ongoing projects. A wider stakeholder involvement will be achieved through seminars and dedicated workshops.

There is a need to build institutional and local capacity in water resources managemnet. This will be achieved through on-the-job training of the personnel of related organizations in the use of tools and models. A dedicated environmental education programme is already underway in the Coleambally Irrigation Area. Arrangement for training environmental staff of other irrigation companies has been made. Some of the other activities to be undertaken through cross-organization projects will include the following:

- development of appropriate educational curricula and training at undergraduate, postgraduate taught courses and PhD research;
- community engagement-representation and conceptualization of regional natural resource management;
- engagement of the general public in natural resource management through the arts and the media.

4. CONCLUSIONS

The HELP initiative has proved to be of widespread interest around the world, North and South. The Demonstration and Operational basins are practicing many aspects of good water governance and can share best practice experience with other basins.

The Murrumbidgee catchment (in Australia) illustrates that a cooperative and practical approach by irrigation farmers, industry and researchers has been delivering research which is sought and used. This work has required multiple stakeholder engagement due to pressures from multiple sectors for increased water to be used to rehabilitate and maintain the health of river ecosystems.

Murrumbidgee HELP initiative is already unlocking the paradigm locks between politicians, policy makers, water managers and researchers.

5. ACKNOWLEDGEMENT

The authors are grateful for the continued support of the Murrumbidgee stakeholders and Dr Mike Bonell and Mr Guillaume Narnio of UNESCO IHP-HELP. The views expressed are those of the authors alone and may not represent the views of UNESCO or the HELP International Steering Committee.

6. REFERENCES

1. Gibbons, M., Limoges, H., Nowotny, H. Schwartzman, S., Scott, P. and Trow, M. (1994). "The New Production of Knowledge: *The Dynamics of Science and Research in Contemporary Societies*." Sage Publications, London.
2. International Hydrological Programme, Technical Documents in Hydrology, No 44 (2001), "The design and implementation strategy of the HELP initiative".
3. Khan S. (2004) Integrating hydrology with environment, livelihood and policy issues – the Murrumbidgee Model. Special Volume on Hydrology for the Environment Life and Policy. *Water Resources Development* Vol. 20, No. 3: 415-429.

4. Kumar, P. B. (2002) *Review of the Groundwater Use and Groundwater Level Behaviour in the Lower Murrumbidgee Valley*. Groundwater Status Report No. 6, DLWC Murrumbidgee Region, Leeton, Australia.

5. Meyer, W. S., Godwin, D. C. & White, R. J. G. (1996) SWAGMAN Destiny. A tool to project productivity change due to salinity, waterlogging and irrigation management, in: Proceedings of the 8th Australian Agronomy Conference, Toowoomba, Qld, Australia, pp. 425–428.

6. Khan, S., Best, L. & Wang, B. (2002) *Surface–Groundwater Interaction Model of the Murrumbidgee Irrigation Area (Development of the Hydrogeological Databases)*. Technical Report (Griffith: CSIRO).

7. Khan, S., Akbar, S., Rana, T., Abbas, A., Robinson, D., Paydar, Z., Dassanayke, D., Hirsi, I., Blackwell, J., Xevi, E. and Carmichael, A. (2005). Off-and on-farm savings of irrigation water. Murrumbidgee valley water efficiency feasibility project, Water for a Healthy Country Flagship report, CSIRO, Canberra, 16 p.

8. Khan, S., Rana, T., Beddek, R., Blackwell, J., Paydar, Z. and Carroll, J. (2005). Whole-of-catchment water and salt balance. Identifying potential water saving and management options in the Murrumbidgee catchment, Water for a Healthy Country Flagship report, CSIRO, Canberra, 16 p.

9. Khan, S., Stubbs, C. M. & McLaughlin, D. (2001) A regional hydrologic economic framework for investigating sustainable irrigated landscape futures, in: Proceedings of MODSIM 2001, Australian National University, Canberra, Australia, 10–13 December 2001.

10. Khan, S., David, R., Beddek, R., Butian, W., Dharma, D. & Rana, T. (2003a) *Seasonal Climate Forecasts for Risk Based Irrigation Area and Environmental Management*. Final Client Report No. CLW61 (Land & Water Australia, CSIRO Land and Water, Griffith, Australia).

11. Khan, S., Xevi, E., O'Connell, N., Madden, J. C. & Zhou, F. (2000) A farm scale hydrologic economic optimisation model to manage waterlogging and salinity in irrigation areas, in: Proceedings of the Fourth Biennial Engineering Mathematics and Applications Conference, EMAC 2000, RMIT University, Melbourne, Australia, September 2000, pp. 179–182.

PROGRESS OF IRRIGATION AND DRAINAGE PROJECTS IN THE NISHITSUGARU REGION AND ROLES OF THE FARMERS ORGANIZATION, NISHITSUGARU LAND IMPROVEMENT DISTRICT

Genichi Shimomura[1]

1- CHARACTERISTICS OF IRRIGATION MANAGEMENT IN JAPAN

1-1- Land improvement districts: In Japan, maintenance of irrigation and drainage systems and water management are implemented by Land Improvement Districts (hereinafter LIDs) organized by beneficiary farmers.

The major roles of LIDs are, besides these, to conduct necessary procedures through consensus-building with farmers for the construction of facilities to realize rational water management, with technological and financial support from the national government, prefectures and municipalities.

1-2- Principle of beneficiaries' burdens: LIDs are managed by directors elected by the beneficiary farmers, and the necessary expenses for managing LIDs are, in principle, covered by dues borne by the beneficiary farmers.

The beneficiaries also share reasonable construction costs and maintenance expenses for facilities with financial support from the organs mentioned above. The projects are, thus, implemented on the principle of beneficiaries' burdens. This ensures the farmers' initiative and makes it more likely that appropriate facilities will be constructed and operated.

1- ex-Executive Director; Department of Agriculture and Forestry, Aomori Prefectural Government;
E-mail: genichishimo@hotmail.com; Tel: +81-17-776-7804; Fax: +81-17-776-7804

1-3- Land Improvement Law:

The construction of facilities and their operation and maintenance, executed under the initiative of LIDs, are based on the Land Improvement Law enacted in 1949.

The Land Improvement Law includes provisions concerning hardware programs that aim to promote the construction of such facilities, and also software programs to operate and maintain them. Here, it is stipulated that the facilities should be managed by LIDs organized by their beneficiary farmers.

1-4- Participatory irrigation management: LIDs organized on the basis of the Land Improvement Law can ensure their financial resources for the operation of LIDs through mandatory authority under the law. Namely, all beneficiary farmers in a specific region must be members of a LID, to which they must pay their dues and burdens.

This manner in which LIDs conduct their activities is designed with a view to participatory irrigation management in the Japanese style.

1-5- Public interest functions and facility management policies: In recent years, irrigation and drainage requires a high level of management technologies, due to an increase in the scale and modernization of facilities. Moreover, urban areas are expanding into rural regions, while the inflow of domestic wastewater and dumping of garbage into canals are also problems. Such changes have sharply raised management costs for LIDs.

On the other hand, owing to declining agricultural incomes caused by falling prices of farm products under the influence of free trade and so on, it is now becoming more difficult to collect or increase dues, thus weakening the financial foundation of LIDs and their management system.

Irrigation and drainage facilities not only play important roles in agricultural production, but also provide public interest functions such as purification of the environment, removal of a region's excess water and conservation of national land. Therefore, how to share the management costs is one of the challenging problems to be solved. In response to this movement, regional residents and corporations are starting such supporting activities as campaigns to beautify the environment or purify water quality, etc. The national and prefectural governments are strengthening public control and assistance, and providing guidance for maintenance and operation technologies, but based on management by LIDs themselves.

In these ways, a new facility management policy is operating with the participation and financial support of governmental organs.

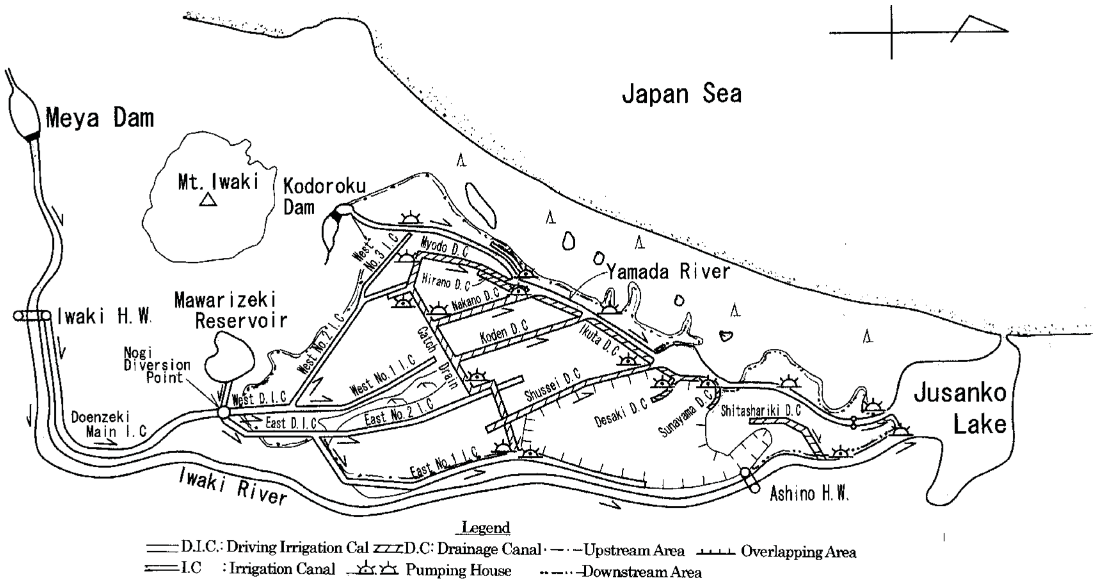


Fig 1. Outline of the Irrigation and Drainage System in the Nishitsugaru Region

Table 1. Progress of the Irrigation and Drainage Projects in the Nishitsugaru Region

Project	Year	1940	1950	1960	1970	1980	1990	2000	Remarks
N. Nishitsygaru	1944-1969								Upstream
N.Nishitsugaru 2nd	1968-1981								Upstream
P. Nishitsugaru	1969-1988								Upstream
N.Iwakigawa L.B	1996-								Upstream
P. Iwakigawa L.B	1996-								Upstream
N. Jusanko	1948-1968								Downstream
N. TaugaruHokubu	1982-1998								Downstream
P. TaugaruHokubu	1985-2006								Downstream
P. Land Consolidation	1970-1994								Entire Area
Iwakigawa HW	1958-1961								Upstream

Legend N: National Project , P: Prefectual Project Prefectural Land Consolidation Project

2. PROJECTS IN THE NISHITSUGARU REGION

2.1 State Of The Region And Improvement Of Facilities

2.1.1 State Of The Region

The Nishittsugaru region is located in northwestern Aomori Prefecture at the northern tip of Honshu Island, Japan. It is a paddy field zone occupying approximately 10,000 hectares on a low flat alluvial fan. Located along the lowest reaches of the Iwaki River, which supplies water for the Iwaki Plain, it has a long history of drought, flood disasters and water disputes.

The peat soil that typifies this region, along with poor drainage, used to form extremely soft ground that caused serious difficulties for farmers' cultivation. As a result, there was considerable demand for the improvement of irrigation and drainage facilities among farmers in this region. The LID, in response to this, played a central role in forming a consensus among beneficiary farmers concerning project plans, sharing part of the project costs and management method of facilities after completing as necessary legal procedures. These missions have been adopted on an individual basis for every national project, prefectural project and others, respectively, and have promoted the development of regional facilities over many years.

2.1.2 Improvement Of Core Facilities

The Nishitsugaru National Project to construct core irrigation and drainage facilities in the upstream area and the Jusanko National Project in the downstream area began before the war. However, following the enactment of the Land Improvement Law in 1949, the projects shifted into a higher gear with the renewal of project plans and the establishment of local supporting systems, and were thus completed in 1968.

2.1.3 Improvement Of Main Irrigation And Drainage Facilities

Following the construction of core facilities, and in response to strong demand from farmers, the Nishitsugaru National Project phase 2 was started in 1967, succeeded by the Nishitsugaru Prefectural Project in the upstream area. The projects aim to construct various pump stations, and to rearrange and improve disordered canals with a view to strengthening drainage systems and setting up water reuse systems, and were completed in 1988.

In the downstream area, the Tsugaru Hokubu National Project and the prefectural project began in 1982, mainly focusing on drainage improvement, and were completed in 2006.

The prefectural projects that followed on from the national project are to construct facilities for a beneficiary area of less than 500 hectares.

2.1.4 land consolidation project and irrigation and drainage networks

Meanwhile, since field conditions are extremely poor in both soil and format in this region, some small groups of farmers and individuals had previously rearranged paddy fields and executed soil dressing as well as underground drainage works.

Given this background, there was a growing movement for farmers to improve paddy fields completely using land consolidation works. In 1969, the Prefectural Land Consolidation Project was started as the largest in scale among such projects in Japan. The intention was to consolidate narrow and irregularly-shaped paddy fields, to make them wider and more orderly with the provision of terminal irrigation and drainage canals. Since the land consolidation works and works to improve canals were conducted simultaneously throughout the entire region, the arrangement of main canals was boldly transformed. By 1994, canals and paddy fields were systematically reorganized to overcome poor topographical, geological and climatic conditions over an area of 9,700 hectares.

2.1.5 Deterioration Countermeasures And Improvement Works

Responding to the accelerated deterioration of facilities due to harsh natural conditions, as well as demands for facilities to achieve more effective use of agricultural land and to conserve the environment, irrigation and drainage projects at both national and prefectural level began in 1996, covering approximately 10,000 hectares of the entire region. These, Iwaki River Left Bank projects, have been reconstructing or upgrading facilities with a view to promoting sustainable irrigated agriculture and stable farm operation.

2.1.6 Related Facilities Constructed In Conjunction With The Irrigation And Drainage Projects

a. Meya Dam

The Meya Dam, a multi-purpose dam with capacity of 3.3 million , constructed in 1960, is managed by Aomori Prefecture. A new Tsugaru Dam is now under construction by the Ministry of Land, Infrastructure and Transport due to the deterioration of the Meya Dam.

b. Iwaki River Integrated Headworks

The headworks take a maximum 18 /sec of irrigation water from the Iwaki River into the main canal, and are managed by a Union of Land Improvement Districts consisting of five land improvement districts. The Iwaki River Left Bank National Project is scheduled to reconstruct these headworks in the near future.

2.2 Activities Of The Nishitsugaru Land Improvement District

To carry out an irrigation and drainage project in Japan, it is necessary to organize an LID covering the whole area where the project is implemented, in order to operate and maintain the facilities which will be constructed by the project.

In the Nishitsugaru region, the Nishitsugaru LID plays this role. By setting the structure of operation and maintenance in absorbing and combining small and medium-size older LIDs in the region, the LID has been promoting such projects while coordinating existing customs and rights which had arisen in the course of history, and obtaining more than 90% agreement from farmers for each project based on the Land Improvement Law (the agreement of two-third or more is required by the Law).

2.2.1 Organization And Roles Of The Lid

2.2.1.1 Organization Of The Nishitsugaru Lid

There are 10,300 hectares of beneficiary area, covering Tsugaru City, Goshogawara City and Tsuruta Town. The organization consisted of 6,127 members as of 2006, including 13 directors, 4 auditors and 95 representatives.

The secretariat has 40 employees under the Chairman of the Board of Directors.

2.2.1.2 Roles Of The Nishitsugaru Lid

The LID's main activities are to promote various projects through consensus-building regarding necessary facility construction, and maintaining facilities, water management including fair water distribution and appropriate drainage, and collecting the cost from the beneficiaries of each project, as well as dues consisting of running expenses and maintenance expenses of the LID.

2.2.1.3 Structure Of The Lid

Decision-making by the LID is based on democratic principles, in order to reflect the beneficiary farmers' wishes by referring to a Representatives' Assembly (consisting of 95 Representatives selected by elections in each district).

The LID is managed as follows:

1- The Directors and other executives manage the LID

2- By passing resolutions under the General Assembly or Representatives' Assembly

3- In accordance with articles and rules required for the operation of the LID

4- Based on the constituent members

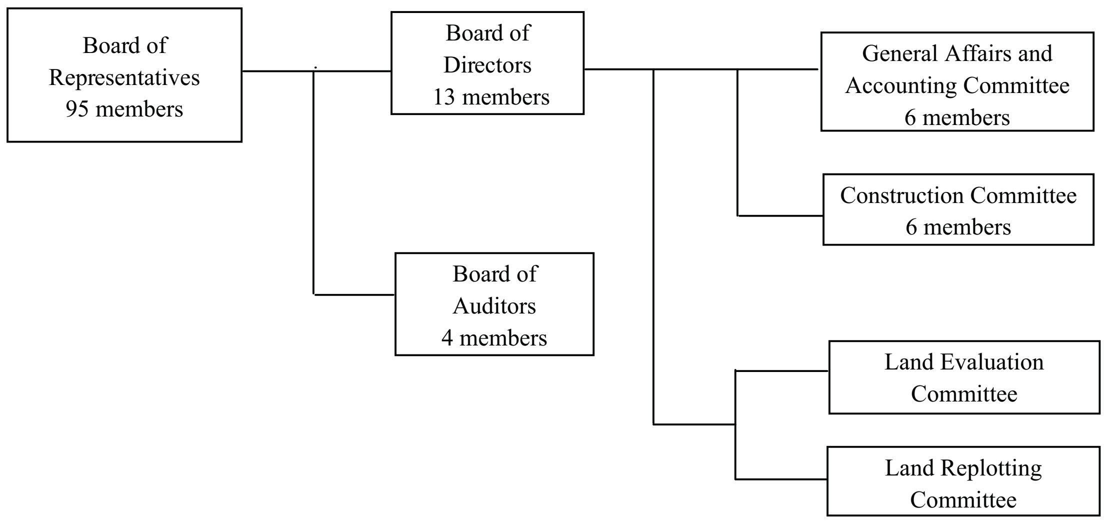


Fig 2. Organizational structure of the Nishitsugaru LID

2.2.2 STRUCTURE AND ROLES OF THE SECRETARIAT

Chairman of Board of Directors

Secretary-General (1 member)

Total 40 members

- General Affairs Division (7 employees)
  - •Budgeting, account settlement, etc.
- Planning and Coordinating Division (6 employees)
  - • Promoting and coordinating various projects, etc.
  - • Publicity activities
- Accounting Division (7 employees)
  - • Collecting member fees (running costs), project costs and repayment of loans, etc.
  - • Arranging land registration and member lists, etc.
- Project Coordinator (1 employee)
  - • Promoting and coordinating various projects.
- Construction Division (18 employees)
  - • Operation and maintenance of all facilities including the Water Control Center

Fig 3. Structure and roles of the Secretariat

2.2.3 Election Of Representatives

Since the Nishitsugaru LID has more than 6,000 members, the decision-making body is the Representatives' Assembly rather than the General Assembly.

A total of 95 Representatives are elected from 11 election blocks by the LID members.

2.2.4 Election of Directors

A total of 13 Directors are elected from 11 election blocks by the Representatives.

2.2.5 Publicity activities

Publicity is one of the important activities for gaining members' understanding and managing projects smoothly when implemented by the LID in cooperation with them.

Publicity activities by the LID are as follows:

- Publication of bulletins: Publishing the "Tsugaru Bulletin" twice a year (April and

January)

- Postcards: Sending announcements about important events and matters (such as the start date of water supply) to the Representatives, municipalities and branch offices of national and prefectural governments concerned, other farmers associations, etc.

- Broadcast by local radio system: Broadcasting issues to concerned villages within the beneficiary region.

- Posting notices: Rotational irrigation plans for drought countermeasures are posted at the diversion and intake point, respectively, notifying dates of irrigation and non-irrigation, and are broadcast at the same time to the villages concerned via the local radio system.

2.2.6 Maintenance of facilities and water management

2.2.6.1 Maintenance of facilities

a. Delivery of facilities

Facilities completed by the national and prefectural governments are delivered to the user, the LID, and maintained by it.

With delivery, two documents ("Management Manual" and "Management Regulations") are provided for regulating the management, maintenance and operation of the facilities, and the LID is supposed to manage the facilities under the terms of these two documents.

b. Training for operating engineers

With the increase in size and sophistication of irrigation and drainage facilities, operating engineers are required to have expertise on high-level technologies and gain the necessary qualifications stipulated in the Management Manual mentioned above. Therefore, the national government is expanding systems to train operating engineers prior to the completion of national projects, in order to promote mastery of operating technologies and make progress with operating systems.

The Nishitsugaru LID has been utilizing these systems and upgrading the technical ability of the engineers in charge.

2.2.6.2 Irrigation systems and facilities in the Nishitsugaru region

a. The major irrigation water for the Nishitsugaru region diverges from the Iwaki River at the Integrated Head Works about 25 km upstream of the region, and is conveyed to the Nogi Diversion Point through the Doenzeki irrigation canal (primary main irrigation canal).

b. Below the Nogi Diversion Point in the region, there are five main canals after two driving main canals, all constructed by the national project, which serve water to terminal beneficiary fields of 500 ha (secondary main irrigation canals).

c. Below the five main canals, beneficiary areas ranging from 500 to 100 ha are irrigated by the main canals constructed by the prefectural project (tertiary main irrigation canals).

d. Irrigation water from the main canal is led to about 12 ha of field blocks through lateral irrigation canals, divided into irrigation ditches and distributed to field lots individually. The lateral irrigation canals and irrigation ditches were constructed by the Prefectural Land Consolidation Project (field canals).

e. This irrigation system provides various supplementary water resources, as follows.

- The Mawarizeki reservoir and the Kodoroku Dam are major supplementary water resources.

- Five pumping stations constructed along catch drains located at 3 m in elevation are to reuse drained water.

- Bi-purpose pumping stations for irrigation and drainage are installed below 3 m in elevation.

- The area along the left bank of the Yamada River is irrigated by pumping water from drainage canals.

- A group of small or medium-size reservoirs is scattered in the surrounding area.

2.2.6.3 Divisions of management between the LID and farmers

Water management and maintenance of facilities are categorized between the LID and the farmers under the principle that major facilities are managed by the LID and on-farm level facilities are left to the beneficiary farmers. Concerning irrigation and drainage canals, the LID undertakes management up to tertiary canals constructed by prefectural projects, while the farmers undertake lateral irrigation and drainage canals and ditches on fields constructed by the Prefectural Land Consolidation Project. Besides these, farmers take care of distributing water, operating gates and maintaining canals at on-farm level, with rules decided by themselves in each unit area.

2.2.6.4 Water management by the LID

a. A centralized management system is implemented at the Irrigation Control Center placed in the center of the region.

b. Water levels and discharge at major points throughout the region are monitored from the Center, and the discharge is adjusted by controlling intake gates through a central-remote manual operation system. Pumping stations are also operated by same system, which controls operating pumps, and the shutting and adjusting of valves from the Center.

c. Water management system

Five employees are stationed at the Irrigation Control Center to monitor and control the system on graphic display terminals, and also they patrol the entire region when necessary.

Two employees are assigned to the East and West Main Canal systems, one to operate each of the intake gates installed at the main canals (secondary and tertiary).

The 26 operators assigned at the pumping stations manage water and facilities and undertake garbage disposal.

2.2.6.5 Rotational irrigation during droughts

a. Start and duration of rotational irrigation

Rotational irrigation starts when the discharge is lowered to less than approximately 6.0

m^3/sec compared to a normal design discharge of 10.9 /sec at the Nogi Diversion Point (located at the entrance to the region), and continues until the discharge recovers.

Because of the recent tendency whereby for the main stream, the Iwaki River, reduces its discharge. Supposedly due to abnormal weather conditions or expanding deforestation, rotational irrigation is unavoidably implemented for one to two months every year.

b. Rotational irrigation method

- To divide water flow using the planed discharge ratio between the West Driving Main Canal and the East Driving Main Canal at the Nogi Diversion Point.

- Three-day rotational irrigation is performed below the Driving Canals. In the case of the west canals, the entire water discharge is introduced into the West No.1 Canal for the first three days, and then on the fourth day, similarly, the entire water discharge is introduced into the West No.2 Canal. Such rotations are repeated every three days.

- The same system is operated on the East Driving Canal side.

- Irrigation water based on rotational irrigation in this region, in principle, is delivered in turn from fields further away from the main canal.

- Accordingly, irrigation water is available for a guaranteed supply even to terminal fields.

- Land consolidation works, providing irrigation ditches along every field lot, have made rapid water distribution possible to the area requiring water.

2.2.7 Maintenance of facilities

2.2.7.1 Facilities managed by the Nishitsugaru LID

Table 2 Facilities managed by the Nishitsugaru LID

Facilities	Irrigation Canals		Drainage Canals		Pumping Stations	Gates	Remarks
	Route	Length (m)	Route	Length (m)	Places	Places	
Totals	51	141,429	53	137,956	68	53	

2.2.7.2 Maintenance by the LID

The LID maintains facilities in the region based on maintenance plans provided by each facility. However, because there are an extremely large number of facilities, the LID tries to carry out systematic and scheduled maintenance and repairs by adopting subsidized projects from the government in order to prevent deterioration and reduce farmers' burdens.

a. Pumping stations and equipment

Daily inspection and maintenance are carried out by 26 operators under the guidance of two center employees. Periodical inspection, maintenance and repairs are entrusted to specialized companies.

b. Heavy machinery owned by the LID

For removal of sediment in irrigation and drainage canals: 3 backhoes

For removal of weeds and algae from drainage canals: 1 algae boat

c. Canal sediment removal plan

The removal of sediment is scheduled once every three years for each canal, taking account of the state of the canals. In addition to such machinery use, workers are hired in case of need.

d. Disposal of garbage

Disposal of garbage piled in the main irrigation canals, six siphons and 28 unmanned pumping stations is carried out by garbage disposal contractors.

e. Melting snow measures

Since melting snow causes submerged damage to urban areas and villages in the region during the spring thaw, accumulated snow in the drainage canals during winter should be removed to let water flow in the canals. Snow is removed and canals cleared by seven leased machines and two self-owned ones.

2.2.7.3 Maintenance by beneficiary farmers

The beneficiary farmers negotiate and decide how to share the maintenance works for lateral canals and ditches (both irrigation and drainage) per water use unit.

Works to be executed are mainly removing mud from canals, weeding along canals and repairing flume joints, among others. Farmers execute such works collectively from April to May before transplanting, and after that, in September, they dig drainage canals to drain water quickly. Other works are carried out when necessary. In case some works need heavy machinery, the LID undertakes temporary recovery works, and at a later point a subsidized project will start, including the restoration works mentioned above together with others.

2.2.7.4 Collection of dues and burdens

Expenses that the LID collects from its beneficiary farmers are dues, consisting of running expenses and operation and maintenance expenses, and burdens of project costs shared by farmers. Dues include personnel expenses and others for the operation of office works, as well as operation and maintenance expenses for irrigation and drainage facilities belonging to the LID. The burdens of individual projects are collected from each farmer who benefits from each project, based on the payment conditions stipulated for the project or loan repayment conditions.

The collection ratios are over 99% for both LID dues and shared project costs, although it takes several years to obtain claims for one year, reflecting the economic conditions facing farmers recently.

2.2.7.5 Details of dues

a. Running expenses: Expenses for personnel, Representatives' Assembly, elections of Representatives and Directors, office works, etc.

b. Operation and maintenance expenses: Expenses for operators of pumping stations and heavy machinery, electricity, gasoline and other fuel for pumping stations and laborers for maintenance works, etc.

2.3 Measures to lower the burden on beneficiary farmers

2.3.1 Measures for project costs

In Aomori prefecture, the national government and the prefecture subsidize approximately 90% of project costs for national irrigation and drainage project. In the case of prefectural projects, farmers' shares are 25% for irrigation facilities and 15 % for drainage facilities. In land consolidation projects operated by the prefecture, the farmers share 27.5 % of the costs.

The municipalities concerned, in addition, subsidized 50 % of farmers' shares for the Tsugaru Hokubu National Project, and are subsidizing the farmer's entire burden for the Iwaki River Left Bank National Project. This is in consideration of the harsh situation of farm management, and the fact that the objective facilities, major facilities in the region, have a high level of public interest.

2.3.2 Measures for dues

There are various measures provided for the LID for the safe and sustainable management of facilities with high public interest functions.

The Nishitsugaru LID is striving to take advantage of these measures to lower the burden on farmers.

2.3.2.1 Subsidy for periodic maintenance and repairing works

Works for pumping stations, dredging canals and others are subsidized.

2.3.2.2 Governmental management of important facilities

The biggest five pumping stations are controlled under the prefecture for appropriate operation and economic assistance.

2.3.2.3 Restoration works by the prefecture

The prefecture implements urgent restoration works for main facilities.

2.3.2.4 Subsidy for management expenses of main facilities

Management an expense, personnel, fuel and others costs of main facilities constructed by the national projects are subsidized.

2.3.2.5 Governmental support for activities with NPOs and regional residents

A new project is scheduled to start in 2007. Joint activities with NPOs and regional residents for improvement and conservation of farmland, water and environment are supported technically and financially by the governments.

2.4 Main effects achieved in the Nishitsugaru region

Over a period of years, the LID has been making effort with beneficiary farmers to promote the improvement of irrigation and drainage facilities, as well as their operation and maintenance.

Such activities have been brought remarkable effects into the region as follows;

There used to be more than twenty farmers' groups, which were in conflict, with each other due to disputes over drawing irrigation water, disposing excess water, and so on. However, thanks to the improvement of a great deal of facilities and as well as united water management by the LID, these problems have been solved and all such conflicts in the region have disappeared.

The improvement of canals and pumping stations expanding from main facilities to terminal field lots, and water management through monitoring and operating at the Irrigation Control Center, have made it possible to achieve rotational irrigation throughout the region, and have thus greatly relieved farmers from the past history of troubled irrigation practices and drought damages.

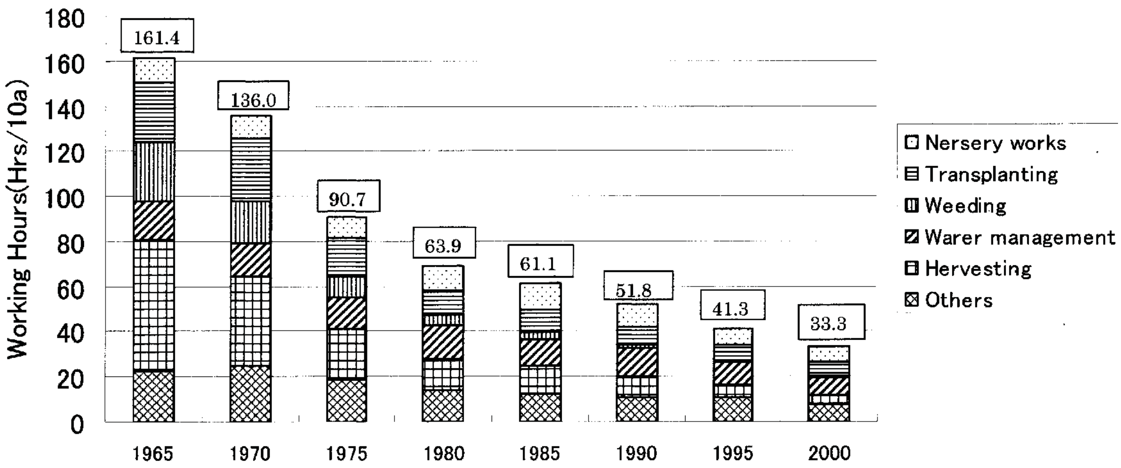
Such improvement of facilities, as well as water management and implementing melting snow disposal, have markedly reduced flood and melting snow damage.

In towns and villages in the region, safe and sanitary living environments have been created thanks to the integration and improvement of a great deal of old canals with reliable water management.

The improved canals, land consolidation works and appropriate water management have transformed ill-drained paddy fields, once a serious problem for the farmers, into well-drained fields where heavy farm machinery operation and upland cropping are possible. Working hours for rice cultivation have decreased drastically to less than a quarter of those compared with forty yeas ago, and the farmers have been relieved from heavy farm works, and obtained highly productive agricultural fields.

Table 3 Change in Unit Working Hours for Rice Cultivation in Aomori

(a prefecture with approximately 85,000 hectares of paddy fields including the Nishitsugaru region)



2.5 Conclusion

This paper aims to refer in detail to the activities that farmers and their organization, the Nishitsugaru Land Improvement District, have executed in the region as an example of participatory irrigation management. The effects have been brought by the participatory irrigation management that the farmers have implemented based on their own initiative. Nevertheless, looking at the progress of improvement, appropriate participation and support by the national government, the prefecture and municipalities, etc., are considered essential to the LID.

REFERENCES

1. Aomori Prefectural Gov. 1996: Historical development of the Land Improvement in Aomori, p682, 689, 895-903, Aomori Prefectural Gov.

2. Aomori Prefectural Gov. 1996: Land Improvement in the Nishitsugaru region, p327-337, Aomori Prefectural Gov.

3. Okabe S. 1991: Agriculture and Rural development, p124, 125, Chikyusya inc., Tokyo

FARMER`S PARTICIPATION IN IRRIGATION MANAGEMENT

Abdul Latif Khan[1], Syed Masoodul Hassan[2]

1. GENERAL

1.1. Utilization of the created irrigation potential and its productivity is not suffering because of lack of technical know how. The most important area, which is not receiving its due importance, is to create an appropriate organization, to frame adequate rules and tools and to develop proper relationship with the farmer clients. A lot of discussion, thinking and research is required to be done towards this and to evolve a suitable pattern satisfying the needs of a project of a region.

1.2. Participation is sharing the power of decision –making, sharing of responsibility and sharing of cost and benefits. To hand over the water at the outlet cannot be said as framer's participation.

1.3. For achieving efficiency in water management and creating a self-sustaining system, minor changes will not suffice in administration. Main point of importance is that farmer should get involved in the management of irrigation system and recovery of water charges. Hence farmer will have to participate in the management of the irrigation. Participatory irrigation management is the only solution. The farmers can participate by becoming members of the Water Users Association (WUA).

2. INTRODUCTION

2.1. Top driven irrigation bureaucracy is managing traditionally the irrigation sector; the authorities responsible for managing irrigation system progressively distanced themselves from the farmers.

2.2. The formation of WUA`s with subsequent system turn over to them is the corner store of the proposed reform strategy. The farmer can better manage minor and tertiary irrigation system then a distant bureaucracy which neither has the staff numbers, detailed local knowledge or incentive to perform these tasks. Handing over the irrigation system to WUA`s enables the hand on management required allows participation in decision making in the management of the main system by stake holder and set the stage for progressively higher level of management by farmers including eventually fully autonomous farmer managed irrigation commands.

1- Executive Engineer, U.P. Irrigation Department, Lucknow, U.P., India, Email: eralkhan@yahoo.co.in
2- Executive Engineer, U.P. Irrigation Department, Lucknow, U.P., India.

3. NECESSITY

3.1 Maintenance of the field conveyance system is a huge and gigantic task. It is just not possible and economical for the government to assume this responsibility of operation and maintenance of the field conveyance system.

3.2 Let us take the example of a canal system. If the over all discharge is 15000 cusec there may be roughly 15000 outlets of 40 hector size. If one person is operating even ten outlets then also 1500 numbers men are required to only operate the outlets. With the reduction of size of outlet command to 10 hector block the need for operation person will be 6000 numbers. In addition much higher number will be needed to maintain the system, which will not be economically feasible.

4. DESIRABILITY

(1) By involvement of farmers in the process of irrigation water management cost will reduce.

(2) Distribution will be better when the farmers will organize and do it themselves.

(3) The conflicts in distribution will reduce when farmers will organize and do this job.

(4) The user clients will become self-reliant.

(5) Volumetric supplies can be given and waste avoided.

(6) Farmers blaming the department and department blaming the farmers for all its ills will be reduced.

(7) By working in close harmony the differences in the goal of farmer and department will reduce.

(8) Farmers will develop a feeling of belongingness with the system for better and economical upkeep.

5. BASIC ISSUES INVOLVED

There are some basic issues, which need serious thought and research for involving farmers in irrigation management process and developing a replicable model for the Indian conditions.

5.1. ACCOUNTABILITY

What should be the accountability of such a farmers society, to whom the society should be answerable? Whether this society should be answerable to the irrigation department or the functionaries of the department should be answerable to the society. If the department functionaries have to be answerable to the society what should be the level upto which they may be answerable to the society. Should there be then a dual control over such functionaries?

Alternatively it may be considered appropriate that upto certain level the functionaries of the department may be answerable to the society also and there after the society may be answerable to some higher level of the department .If it is so then what should be these levels.

5.2. SIZE OF COMMAND WITH SOCIETY

What should be the size of command in society? How big should be the membership number for the successful functioning of the society? It should be big enough to render services economically and small enough to be easily manageable able seek cooperation of the individual members. In the light of the experience gained from the existing successful societies and according to the local conditions this size has to be fixed.

5.3. HYDRAULIC V/S ADMINISTRATIVE UNIT

It is convenient to form societies based on existing administrative units because of the existence of age-old bonds in the community of the same village. It is very difficult to forge cooperation amongst different villages. Unfortunately water resources in the nature do not respect political boundaries. Their distribution can be planned only basin or sub-basin wise. The canal system has to follow the watershed lines, which run across the village boundaries. The outlet command of even one outlet covering a 40 Ha block often covers more than one or two villages. Therefore for the formation of a society even of the smallest size we have to cut across such man made boundaries.

5.4. ORGANIZATION OF THE SOCIETY

What type of organization the society should have? Should it be an extension of the existing departmental hierarchy or it should be an independent institution with its own aims, objectives and programmes. Will the department be willing to shed some of its powers and responsibilities? To what extent the powers are needed by the society and should be handed over to it? What type or relationship it should be having with the department in the over all interest of the health and efficient functioning of the society. All these areas need a careful study and thorough debating before reaching any conclusion.

5.5. HOW TO ENSURE SOCIAL JUSTICE

Bigger established organizations are better equipped to resist undue pressures from outside and ensure better social justce. Some new born in democratic setup can easily be enticed by a power block to follow their line. If it is allowed to so happen it may rather become an instrument of injustice to the poor and powerless and may become an instrument for promoting corruption in the society.

There is thus a strong need to study the existing social environment of the area which is likely to be taken up for the formation of such a society. The areas where the existing environment is not conducive to so co-operatives and the co-operatives are not likely to be productive may be excluded from the programme in the first instance.

5.6. HOW TO ENSURE FAIRLY PREDICTABLE SUPPLIES OF WATER

Unfortunately the supplies of existing canal system particularly of river diversion system is quite unpredictable as regards time and quantity. When the farmers are not sure of getting the allotted quantity of water it become very difficult for the societies to survive on such systems. What are the ways to introduce flexibility to the system at an affordable cost? Different ways may have to be devised for different situations. Some prediction may even be possible in the present structure of the system.

Unauthorised irrigation, the law and order situation in general and too much frustration in the staff and the important contributing factors to unpredictability and inefficiency. The system will have to be kept properly maintained and with proper structuring and professional management, the staff working can be motivated to work and improve its performance.

5.7. GAINS TO FARMERS/DEPARTMENT

Before coming for the formation of a `society`, the farmer naturally think, what they will be gaining from doing so? The Department the existing bureaucratic set up may on the other hand feel reluctant in parting with their power. Why at all they should allow farmers to interfere in their working. Why farmers on the other hand should take all the pains for managing and maintaining the system?

In India the root of democracy have now spread deep and wide in general have refused to accept the domination of the government department, some poor and powerless yet feel that the power to manage the water should remain with government department failing which they may further get exploited in the hands of influential few. It has become impossible even to apply existing laws on such a mass scale to check unauthorized practices in irrigation, to cuts and buns in the canals, to reduce fluctuations and to feed the tail reaches. To make strict coercive rules to check the large-scale irregularities and to apply them with a massive force on the vast majority of the irrigators may not be possible in an open and free society like ours. The only remedy then left is to make the farmers responsible for its management.

Now the clear gains to the department are that it will have the satisfaction of having contributed to a cause of national good and having saved itself from the responsibilities, to fulfill which, it is not in a position to exercise power.

Now the clear gains to the department are that it will have the satisfaction of having of having contributed to a cause of national good and having saved itself from the responsibilities, to fulfilling which, it is not in a position to exercise power.

The farmer on the other hand by assuming this responsibility will become more self reliant, will be saving on maintenance and distribution charges and with a sense of belonging they will be protecting their works and saving on huge repair cost. The efficient application of water will also reduce the cost of water, energy and save costly fertilizer from getting leached down due to excessive application of water.

5.8. LIBERAL USES OF WATER IN THE BEGINNING OF A PROJECT

Whenever a new project is on its way to completion i.e. part of its distribution system having been completed, the entire available water is pushed to the part already completed. As a result the farmer of that area start suddenly getting water and that too, much more in quantity than what they will be getting on its completion. Sometimes due to some hindrance in construction on the remaining part of the system, this situation continues for so many years. The farmers in these areas start growing paddy against the present and assumed cropping pattern in the project. It becomes impossible later on to reduce the supplies and bring them back to the proposed cropping pattern. In such areas where the liberal use to water becomes a practice, it is very difficult to form `societies` and bring them back to disciplined use of water.

Care has thus to be exercised right from the inception of the project that the farmers do not develop such practices and the disciplined use is there as a habit. Thus it becomes easier to encourage formation of farmer's co-operatives on new areas than on areas already having a practice misuse or undisciplined use of water.

5.9. EXTENT TO WHICH FARMERS BE INVOLVED

To what extent the farmers should be involved in the management of a project in the Indian conditions is a matter needing thought and discussions. Different experiments may be conducted about the extent of their involvement and most successful model be picked up for wider application. The physical areas for their involvement are the Outlet, Minor, Distributory, Branch canal.

The activities for the involvement are Operation, Maintenance, Constructions, Planning and Design.

6. PARTICIPATORY IRRIGATION MANAGEMENT IN U.P. BY PACT (U.P. WATER SECTOR RECONSTRUCTING PROJECT)

6.1. As per the U.P. government at resolve as stated in the State water policy, PIM is going to be introduced in Jaunpur Branch Command area and Bahraich Dy of Imamganj Branch Command area under the project. In this connection, WUA`s will be framed and activated. These WUA`s will participate in Rehabilitation of canals and drainage system. These WUA`s will do the following:

(1) Participatory water distribution in 1st stage by outlet committee.

(2) Transfer of Minor canals to WUA`s in 2nd stage by minor committee.

(3) Making WUA`s capable for collection of water charges and financial management.

(4) Volumetric charges will be introduced and charge measured at the head of the minor canal will be charged. This method will avoid defects of the area measurement based charging system.

(5) In the last stage, Distributaries, branches and canals will be transferred to the WUA`s.

6.2. OBJECT OF THE U.P. WATER SECTOR RESTRUCTURING PROJECT:

In short the objectives of UPWSRP are as follows:

(1) Accelerate the productivity of water-better water management.

(2) To increase yield of crops.

(3) To increase income of farmers-poverty alleviation.

(4) To bridge the gap between irrigation potential created and actual utilization.

(5) To use water equitability and efficiently.

(6) To instill amongst farmers a sense of ownership of project and water.

(7) To hand over M & R and management of canals to WUA`s achieve-

- (a) Increase in quality
- (b) Appropriate use of funds
- (c) Decrease dependence on Government
- (d) Downsize Government's administration
- (e) Achieve significant reduction in Government expenditure
- (f) Obtain help from International Organization
- (g) Streamline water management.

6.3. STRATEGY FOR PIM

1- Approach

(1) By law legislation- Top to Bottom approach

(2) By motivation approach- Bottom to Up approach.

2- Principles of PIM

(1) Restructuring the Government department

(2) Empower water user association

(3) Farmer's Financial control

(4) Create mutually accountable partnership

(5) Redesign Government assistance to stimulate local investment

(6) Development choice of the service provider

3- Factors for success

(1) Enabling Environment

- (a) Policy document
- (b) Committed leadership
- (c) Committed administration

(d) Committed executive workforce

(e) Enthusiastic Farmer

(2) Transfer Implementation

(f) Involvement of farmer through WUA in decision making

(g) Use of local leadership

(h) Changing of agencies

(i) Monitory of WUA`s

(j) Confidence building measures

(3) Intensive training Awareness campaign

(k) Awareness about water scarcity to farmers

(l) Awareness about participation to farmers as well as officers/officials

(m) Training on day to day working to farmers

(n) Training to officers/officials to get ready for emergency trend in duties.

7. FORMATION OF FARMERS COOPERATIVE

(1) Any aid given by the govt. to society acts favorably to its formation and survival.

(2) Government giving water to the society at a lower rate proves a good incentive ti its formation.

(3) If at all there is binding on society to distribute water to its member on a fixed rate the recovery rate should be economically viable. It should be comparatively advantageous to members and profitable to societies to meet its running expenses.

(4) Rehabilitation of an old scheme before handing over, works as a good incentive for farmers to unite and form a cooperative.

(5) If the govt. comes forward and bears the risk of loss to society during initial years, it finds a very favorable response among the members of the society.

(6) In case some processing industry is attached to the society, the income of its member grows. This acts as a binding force for the members to come forward and remain united.

(7) It is easier to form farmers cooperatives by creating suitable conditions on a new project then on an old one where wastage, misuse, wrong cropping pattern and inequity is in distribution has become and way of life.

(8) Other appropriate incentives according to local conditions may also find a favorable response.

7.2. MEMBERSHIP SUPPORT

(1) Homogeneity of members

In case the member of the society are of the same caste and status it is called homogenous. Better the homogeneity better will be the bon in its members, which will act favorably to its formation and survival.

(2) Educational status

If the educational status of the members is better, it will be easier to bring them together and run a cooperative.

(3) Fear of the risk of loss tends to affects adversely to the formation of the society.

(4) If the financial status of the member is better it will be easier to convince them to cooperate for mutual benefit.

(5) The interest of members is protected they will be motivated for coming together.

(6) Where the members are having other sources of livelihood also, it will be difficult for them to come closer and form a society.

(7) On the whole gain to members in forming a society bring them together. If they would not find a substantial gain by cooperation they will not get motivated to do so.

7.3. LEADERSHIP SUPPORT

The role of leadership is vital to the formation of a society and its subsequent survival. The leadership must have the following qualities to be successful in the task.

(1) It must have enough dedication in doing the job.

(2) It must work with honesty and with a spirit of public service.

(3) It must have proven credibility amongst the members.

(4) It should have a record of social service.

(5) It must have enough influence on local people.

(6) There should be an inbuilt arrangement of conflict management.

7.4. SYSTEM INCENTIVE

The type of system also has its influence on the successful formation of a farmer cooperative and its subsequent survival.

(1) If the existing system is facing difficulties in good operation, maintenance and distribution and is in crises it become easier for the members to come forward and unite and form a cooperative.

(2) A good system with successful warabandi will work unfavorably to the interest of farmers cooperative: People do not feel it necessary to form and manage a cooperative, which is not going to give them adequate incentives.

(3) The system where cash crops and grown, farmer tend to form cooperative for the management of water because the risk involved in failure of crops become substantial.

(4) Employment of independent irrigator for irrigating the fields ensures more judicious watering and less wastage. It ensures better quality and consequently lowers the number of conflicts. The survival of society thus becomes healthier.

(5) Non-Remunerative cropping pattern in the command acts unfavorably to the interest of formation of a farmer cooperative.

(6) Uniform irrigation i.e. enforcement of equity in the system tends to keep the members united.

(7) Use of catalytic agents in convincing the farmers about the benefits of formation of a society also acts favorably in the community.

8. CONCLUSION

8.1. The farmers must be involved in all spheres of the project, right from, planning stage to construction and upto maintenance in all aspects.

8.2. Construction of dams, weir barrages and large canals would be extremely difficult for farmers to handle. Government provides us with all available institutional resources, departments, agencies, trained staff etc. that can be used to get things done.

8.3. Farmers have some comparative advantages as well. They have direct incentives to manage irrigation water in a productive and sustainable manner, they offer on the ground presence that even the most dedicated off-site agency cannot equal and they have an intimate knowledge about their fellow irrigators.

8.4. When farmers are directly involved in the design process whether for new systems or rehabilitation of old ones, they will provide useful design input and they will come away with an understanding of the design logic of the system they will be managing. During construction farmer input has the functions of quality control, costs saving and construction knowledge.

8.5. Farmers participation will reduce the cost of operation and maintenance. Farmer can enjoy better service and cost savings, the government incurs less management cost and can then afford to improve in the main system.

8.6. The organization that farmers establish for managing their irrigation system constitute a form of social capital that can have spin-off effects in the other aspects of social and economic life. The network of contacts among agency staff and the water user organization leadership, can bring the farming community into closer touch with related services e.g., credit, education opportunities or even political access. And the skill that farmers learn through their experience with their water user organization- accounting, budgeting, planning organizing, constitute a set of knowledge that can be used in many other productive endeavors.

8.7. For achieving efficiency in water management and creating a self-sustaining system, minor changes will not suffice in administration. Main point of importance is that farmers should get involved in the management of irrigation system and recovery of water charges. Hence farmer will have to participate in the management of Irrigation. Participatory Irrigation Management is the only solution.

The farmers can participate by becoming members of the Water User's Associations (WUA).

8.8. The formation of WUA`s with subsequent system turnover to them is the cornerstone of the proposed reform strategy. The farmers can better manage minor and territory Irrigation system than a distant bureaucracy which neither has the staff numbers, detailed local knowledge or incentives to perform, these tasks. Turning over the Irrigation system to WUA`s enable the hand on-management required, allows participation in decision making of the main system by the stakeholders and sets the stage for progressing higher level of management by farmers including eventually fully autonomous farmer managed Irrigation Commands.

PARTICIPATORY IRRIGATION NETWORK MANAGEMENT
A CASE STUDY IN QAZVIN

A.Sotoodehnia, M.Askari, A.Kakahadji, M.Sheikhhoseini and J.Razzaghi

ABSTRACT

Iran, with 1,648,195 square kilometer area is placed in a dry zone of the world. Average annual precipitation of Iran is equal to 250mm. It is predicted that, in 1400 (2021) the volume of water per capita per year will be about 1300 m^3. Qazvin plain irrigation network is placed in 150 Km west of Tehran. Totally 278 MCM volume of water is conveyed by 9 Km tunnel from Taleghan storage dam into Ziaran diversion dam and then convey to Qazvin irrigation network. Main canal and laterals have concrete lining and have cumulatively 1100 Km length. Capacity of main canal varies from 30 to 3 m^3/sec. Total irrigated area by this network is equal to 80,000 ha. Currently, "Utilization & Maintenance of Qazvin Irrigation Networks Company" under surveillance of "Ministry of Power" manages the distribution network. Governmental system is unable to manage network utilization correctly; furthermore, farmers don't have sense of ownership about the network and their related structures. Farmers don't play effective role on water distribution affairs. Thus, network dose not have appropriate function. This paper suggests applicable techniques upon rural cultures, customs and manners. For participate "Water User Associations (WUA)" on irrigation management. In this way, legal impediments and lack of laws are considered. Participate WUA's on Qazvin irrigation management must be a gradual process and done during 5 years. For the first & second years, while participate legal representatives on utilization & maintenance of irrigation networks, 51% stocks of present company will be transfer them. In third & forth years, laws must be modified and legal impediments remedy. Farmers need to learn skills and educate about network utilization. This stage contains these required educations. Final goal will be accepted after fifth year and all affairs on irrigation management will be transferred for WUA's.

PREFACE:

Iran with 1648195 sq km area is pleased in dry zone of world. Total area of agricultural lands is about 17.7 million hectares, that about 7.2 million hectares of these lands irrigate about 1.3 million hectares of them have irrigation network. Total volume of water per capita in 1375(1996) was about 2160 m^3 and it is predicted that in 1400(2019) this amount will be just 1300 $m^{3.}$ however, all main & sub main canals have concrete lining but researches shows that distribution and conveyance efficiency of water in this network is about 50% that equal to earth canals. In point of view experts, main reason of this problem is refer to lake of participation farmers in schedule, utilization & maintenance of irrigation networks affairs. Participation of farmers in utilization & maintenance management is scope of this research. The Qazvin irrigation network has selected pilot in first stage.

This paper suggests applicable techniques upon rural cultures, custom manners and financial considerations. In other hand, costs of utilization & maintenance, transfer management of network and supervision of WUA’s (Water User Associations) has considered.

DONE RESEARCHES

Several researches done on participatory irrigation network management in Iran & other countries of world. Some of most important are:

1- Utilization system of agriculture water (Jamab consulting engineers, 1375(1996))

2- Utilization system and participatory of peoples on L2 canal of Qazvin irrigation network (Ab Tose Paydar consulting engineers, 1379(1998))

3- Workable techniques on creation WUA’s on irrigation network (A.Poorzand, 1383(2002))

4- Review of Qazvin plain irrigation network studies (Pandam consulting engineers, 1384(2004)

Also there is many experiences on utilization & maintenance irrigation networks to farmers in other countries from 3 continent (Asia, America and Africa)

MAJOR INFORMATION ABOUT QAZVIN PLAIN:

Region that studied is placed on reach Qazvin plain that is located in Qazvin province in 150 km distance from west of Tehran. Upon statistics of Qazvin synoptic station, average of annual temperature is 13.9 $^{\circ}$C, average of annual precipitation is 324.8 mm and average of rational humidity is 51.5%.

Amount of evaporation from class a pan estimated 1669 mm per year.

Net area of Qazvin irrigation network is equal 58000 ha that about 72% of it consists of class A & B lands. This network begin from Ziaran river in east of Qazvin plain & was extended to Takestan city with 92 km length & 8.7 km average width.

SOCIAL & ECONOMIC PROJECT STUDIES:

Social & economic studies have important role for suggest workable plan on irrigation network management transfer to farmers. Summary of this studies are:

POPULATION & POWER MAN INDEXES:

According 1384 statistics, population of 77 villages in Qazvin plain was 145295 persons in 31560 families. This amount in 1375 was 111372 persons in 21900 families. Then increase rate population between 1375 and 1384 was estimated about 3 percent.

STUDY & LITERARY:

Done researched shown that, from 6 years and older persons who lives in Qazvin plain 79.7 percent have literacy. This ratio for men is 85.5% and 72% women.

SHARE CROP METHODS:

Share crop method is this region are in below forms:

1- Farmers who they have land and work on land.
2- Share croppers who they don't have land but work on others farmers land and get some part of production.
3- Common in some region, common of people have stock from one land. They work on land and share profile of production upon their stock.

QAZVIN IRRIGATION NETWORK CHARACTERISTICS

This network has impure 80000 ha area. it begin from Ziaran and ended to kahak in Takestan. This network cover Qazvin, Abyek, Takestan and Boeinzahra agricultural lands. Upon hydrologic divide, this region belong "shoor" basin. This network don't have drainage system and infiltrated irrigation water in form of ground water convey to Qazvin slough. Finally net area of lands that irrigated by this network is approximately 58000 ha. But in initial plan this amount had predicted about 52000 ha. It means in 6000 ha exceed area irrigated now. Annual water requirement of these lands has been calculated according initial program about 366 MCM. Cropping pattern consist of 50% autumn planting include wheat and barely. 15 to 25% of lands have been allocated to spring planting and 25 to 35% in fallow. 99 MCM volume of needed water provide from well and 184 MCM from "Taleghan" river. By construction of Taleghan storage dam, total volume of allocated water for Qazvin plain will be increase to 278 MCM. Presently, "Sangban" division dam, Taleghan convey tunnel, main & sub main canals with 94 & 220 km length & 3 to 30 M^3 capacity, lateral and farm canals with 880 km length have been constructed and utilize now. From 78 dug wells, 63 wells belong to utilization & maintenance of Qazvin irrigation network company ("UMQINC") and 53 wells utilized now. 40 wells are under construction. 9 wells don't have any discharge and remain wells will be complete & outfit in early future.

QAZVIN IRRIGATION NETWORK MANAGEMENT

After implementation of "Land reform law" in 1341(1962), "Qazvin plain irrigation company" established for provide drink & agriculture water by water & electricity ministry. After Islamic revolution in 1357(1979), agriculture ministry created agriculture service centers for organize farmers in associations that named agriculture councils. These councils were taking cropping pattern, seed and fertilizer from agriculture service centers and distribute between farmers. Most activities of “Qazvin plain irrigation company” was consist of:

1- Complete Qazvin irrigation network and resumption dig of deep wells
2- Provide drink water for about 150 village of Qazvin plain
3- Utilization from agriculture deep wells placed in plain
4- Utilization from Qazvin irrigation network
5- Survey, conservation and management of water resources.

In 1370(1991) “Qazvin plain irrigation company” renamed to “Qazvin regional water affairs administration”. “Utilization & maintenance of Qazvin irrigation network company (UMQINC)” established in form of “join stocks” also in 1372(1993). This company has been working subject water affairs administration but was independent. Governmental systems are unsuccessful frequently and had been predicted that at least 51% stocks of this company assign to farmers. Gradually, it got private form but state operation. “UMQINC” stocks also, deposited to power ministry subject companies (49% to Tehran regional water company and 51% to “Lar” & “Reyab” consulting engineers) instead farmers. Different parts of company, have been working under 3 below manager:

1- water distribution management
2- repair & maintenance management
3- finance & office management

Mention managers also subject to general director. Water distribution manager in addition supervise east & west parts of main canal operator and head of water distribution office. Sub main canals operators, were working subject head of water distribution office. Sub main canals operators were delivering water to agriculture councils in lateral turnouts. Repair & maintenance affairs has related to maintenance manager. In 1384(2005), water distribution management transferred to WUA’s and “UMQINC” work by 18 organization posts that was not enactment yet. This posts are include coordination & utilization affairs, executive & technical affairs and finance & office affairs.

FORMATION PROCESS, EXISTENT STATUS AND ROLL OF WUA’S ON QAZVIN IRRIGATION CONDUCT

New triennium plan of Qazvin irrigation network utilization system, designed by “UMQINC” & executed since 1381(2002). This plan consist of 3 below stages;

1- first stage one years lasts include, system design, planning, basic information collection about lands, owners, water requirement and cropping pattern planning, well’s hydrometry and provide water supply & utilization contract minute upon 158 lateral’s turnouts.

2- Second stage one year's lasts include, registration of 30000 farmer under 88 association, appointment of farmer's representatives, ratification of water supply & utilization contracts and registration & start working of WUA's.

3- Third stage one year's lasts include, deliver canals, establish "cooperatives" on sub main canals, "UMQINC" stocks transfer, provide cadastre maps and real participation of WUA's on utilization & maintenance of irrigation network.

REALIZATION SCOPE OF PLANE REVIEW

1- 158 WUA's were established and registered. Association's Head, secretary and clerks were defined by farmers in election

2- 8 cooperatives were established, but didn't registered yet

3- "association's club" was established and seated in "UMQINC"

4- Registration of these associations in form of join stocks or cooperative companies were did not yet. This object were devolved to "association club". Stipend of club's, cooperation's and association's personnel pay from 7% water charge that receive from farmers

5- Cadastre maps was not provided yet

6- "UMQINC" stock was not transferred to farmers and cooperatives up to now

7- According realization of plan scope, the "WUA's engineering & support services company" was not established

8- And finally, management of irrigation services that had been most important goal of plan was not transferred to farmers.

EXISTENCE STATUS FUNCTION ANALYSIS

ANALYSIS OF FACTORS AND CONDITIONS THAT AFFECTED ON FORMING WUA'S

Most effective factors that help to forming WUA's in Qazvin irrigation network are:

1- good function and solidarity between agriculture organization & Qazvin plain irrigation company records

2- existence of agriculture councils

3- lack of water right before construction of irrigation network

4- modern irrigation network

5- existence of studied records and general director's effective role

6- management & financial independence

7- water charge reception and regular volumetric water distribution

8- good financial status of "UMQINC"

9- successful world experiences

10- compatible government opinion

11- regulated water

12- sustain financial stamina of WUA's

REVIEW AND ANALYSIS OF STRUCTURE, WORK ROUTINE, AND FINANCE MANAGEMENT OF EXIST WUA'S AND FUNCTION OF "UMQINC" AT PRESENT

As pre nominated "UMQINC" fall to constitution of 158 trade WUA's association,8 cooperative and one "association's club" in 1384(2005). Board of directors of this club, were elected by association members and club work under supervision of "UMQINC" via annual ratification contract with this company. We will be describe each element of organization.

1- agriculture councils:

These councils are subset of WUA's. for many years, utilization & maintenance of lateral and farm canals, was under taken of agriculture councils and "UMQINC" had no role on this matter

2- trade WUA's:

Each association has sponsorship of some agriculture councils that their farm lands were placed downstream of a lateral turnout. Take water requests from agriculture councils and forward to respective cooperative and distribution of water between farmers in lateral & farm canals are most tasks of associations

3- cooperative:

most task of these companies include, take water requests from sponsorship associations and forward it to "club", receipt volumetric water from "club" (in main & sub main canal's turnouts and deliver to associations. Utilization & maintenance of sub main canals perform by cooperatives

4- trade WUA's club:

this club established, registered and board of directors election was setup in 1383(2004).main task of this club is, take water requests from representatives of cooperatives, coordinate this queries with "UMQINC" and deliver water to cooperatives in main & sub main canal's turnouts.

MOST TASKS & OPTIONS OF "UMQINC" AND COOPERATIVES:

1- COOPERATIVE TASKS:

- Buy & distribution of allocated water to WUA's
- Protection and systematic maintenance of installations and structures of wells
- Protection and systematic maintenance of structures and hydromechanical conveyance and distribution canals

- Dredge, repair and maintenance of sub main, lateral and farm canals installations and structures in their operation
- report faults, failures and erosion of network and violations of water users to water distribution office and represent offenders to court

2- **"UMQINC" TASKS**

- Provide & deliver required water from surface & subsurface resource during year and take water charge according water distribution schedule.
- Supervision allocation, distribution and volumetric delivery of purchased water by cooperatives.
- Implementation main repair of conveyance & distribution canals installations and wells on time
- Continually services on legal support and plead in court and prosecute offenders

EVALUATION OF "IRRIGATION SERVICES MANAGEMENT TRANSFER" PLAN FROM FARMER'S POINT OF VIEW

For evaluation of this plan and get farmer's view points, convoke farmers and constitute many sessions. Some of questions asked in form of questionnaire from farmers. After take questionnaire and analysis answers, these results obtained:

- 75% of farmers believed that after establishment of associations, cooperatives and club, illegal water use, canal lining destruction and turn outs manipulations was reduced
- 75% of farmers repined from canals and wells repair, and declared big difference wasn't occurred.
- 25% declared, their productions was increased by square water distribution
- 58% declared, after WUA's establishment, most farmers complains resolve at their office & recourses to "UMQINC" was reduced
- 91.7% of farmers were evaluated function of "UMQINC" bad or not good not bad

SOLUTIONS & SUGGESTIONS

IMPLEMENTATION & DIFFICULTIES ON WUA'S STABILITY ANALYSIS

Up to now, participatory irrigation management, was not legalized and farmers expect in ratio of their share, participate on decide and irrigation network management. Then transfer "UMQINC" stocks to beneficiary farmers, predispose to legalize participation of farmers on irrigation networks management. In addition, governmental companies interposition will become at least. According clause 22 and 51 "square water distribution" law, power & jahad-keshavarzi ministries should supervise on execution of "optimize usage of water bylaw". According clause 29 footnote, lateral & farm canals construction and distribution of water, was devolved to agriculture ministry. So it shows that all activities of water industry from provide to distribution of water was devolved to government and WUA's have no any effective role on this affairs.

One of the most important worries of farmers is water charge payment. This subject, unfortunately have negative effect on formation process of WUA's, because most farmers was not justified about water abonne.

FINANCE STATUS OF "UMQINC"

As a rule, in companies that their B/C (benefits per costs) ratio is greater, they have more chance and better favorable conditions for participate WUA's on utilization & maintenance of modern irrigation networks affairs. Financial information of "UMQINC" was taken between 1379(2000) - 1384(2005) years and these results were derived from table 1:

Table 1: Incomes and costs of "UMQINC" (million rial)

YEAR / B or C	1379	1380	1381	1382	1383	1384	1385*
income (contract)	2,400	3,300	3,352	3,900	4,900	5,510	6,612
Real income	2,601	2,661	3,865	5,100	5,891	7,997	10,816
Costs	2,419	2,245	4,017	4,782	5,306	5,320	6,384
Net B or C (tax subtract)	179	416	-152	300	438	-	-

* predicted

- "UMQINC" was frequently profitable
- Real income of "UMQINC" during 1383(2004)-1384(2005) was been equal to 5890 and 7997 million rials corresponding and it is predicted that this amount reach to 10816 million rials. This income can be use for maintenance and repair of network and compensate costs of network management.

APPROPRIATE PLAN FOR FORMATION AND PERMANENCY OF WUA'S ON QAZVIN PLAIN

Farmers reject quick transfer irrigation network management. Most worries are including:

- Afraid about responsibility of reconstruction costs of network and tax
- Lack of enough experiences with management, techniques, utilization & maintenance of network affairs
- Wear off canals lining and necessary to recondition
- This transfer must be in gradual process and at least 5 years need for solidification.

IMPLEMENTATION SIMPLE STRUCTURE THAT HARMONIZE WITH TRADITIONS

One of the most important factors on formation & stability of WUA's having harmony with people's culture & traditions

PREVENTING ABOUT MAIN & SUDDENLY REFORMS

Notwithstanding, disadvantages and objections, relevant associations a good plan should consider 18 month effort on formation of this associations and try to complete and remove deficiencies according scheduled program.

SOCIAL JUSTICE

Its necessary an appropriate plan, privilege WUA's same as government companies during management transfer progress.

FINANCIAL MOTIVES

Positive balance sheet, create motives for farmers participatory.

FINANCE CERTIFICATION

Annual costs accounting and continually audits of WUA's finance function during management transfer in plan is necessary.

DECENTRALIZATION

Power ministry, must privilege enough options to estates water affairs companies, for irrigation management transfer to WUA's.

PROVIDE REGULATED WATER

Existing regulated water play important role on stability of WUA's. construction of Taleghan reservoir dam, was realized this factor.

SOCIAL AND LEGAL POSITION OF WUA'S

Identification and support WUA's as legal representatives of farmers had positive feedback within rural societies.

PLAN ADMINISTRATOR

In successful plan, plan administrator play important role in management transfer in most countries that have successful experiences on "PIM". Administrator (consultant + navigator) have vital role.

IMPROVEMENT & RECONSTRUCTION

During management transfer, improvement of network can create motive to accept responsibilities by farmers.

COMPATIBLE WITH CURRENT LAW

Change of current laws is necessary but it is time consume process. Then a good plan must be a compatible with current laws.

PARTICIPATE AND TRANSFER QAZVIN IRRIGATION NETWORK MANAGEMENT TO WUA'S

A 5 years length period was considered for complete plan. During this period structural, managemental, financial and legal corrections must be implementing as plan is in progress. In this plan important topics are:

FIRST YEAR: ADVISEMENT YEAR

In first year, preparation of legal bed and preparatory actions will perform for transfer 51% stocks of "UMQINC" to WUA's. In addition, some reformations need as below:

1- Trade water user association's reinforcement.

2- Reformations in cooperatives.

3- Reformation in utilization and Maintenance Company.

SECOND YEAR:

In second year, according reformations in first year and consideration "clause 5" of power & agriculture ministers agreement, 51 percent stock of "UMQINC" will be transfer to WUA's (as legal farmers representatives). According trade law, farmers via their representatives, have restrict participation in irrigation network management.

THIRD YEAR

In third year, 41% leaving stocks of “UMQINC” that belong to governmental companies, will be transferred to WUA’s. Therewith, all stocks of “UMQINC” will appertain to WUA’s and governmental sector transfer all management affairs to WUA’s

FORTH YEAR

In forth year, these items predict to be performed:

1- Assignment all governmental tracks & machines, to “UMQINC”.
2- Increase company investment from 100 stocks 20000 rials to 80000 registered stocks 50000 rials. For each hectare of lands (80000 ha) one stock was considered.
3- Emission licenses of water utilization for lands area that belong to each association.
4- Emission stocks paper for each association.
5- Improve exist database and network.
6- Monitoring and evaluation of irrigation management transfer to WUA’s process.
7- Correct & complete 5 years plan routine.
8- Advice during 4^{th} years, WUA’s employ consults for technical help.

FIFTH YEAR

METHOD 1: TRANSFER OWNERSHIP OF IRRIGATION NETWORK

According results of questionnaires, 50% of farmers are disagreeing with transfer ownership of irrigation network and 50% agree eventual.

Its show that, there are basic themes for gradual transfer. By transfer irrigation network management during 5 years, farmers found benefits and maybe agree with ownership transfer.

METHOD2: AGRICULTURE WATER ABONNE

In comparison of network ownership transfer to WUA’s, there is other option and it is, catch water abonne. That was predicted in “square water distribution law” and communiqué to regional water company by power minister, in 1375(1996). According to questionnaires, 50% of farmers agree with second method.

AGRICULTURE WATER CHARGE

If irrigation networks ownership, transfer to WUA’s, protect & maintenance of network will be increase because ownership sense and maybe cause farmers agree with increase water charge. Specially, if farmers be confident that all of water charge will use for their network.

WUA' ADMINISTRATION

Guidance and administration of WUA's by professional & expert will be continue, until 5 years of plan, main tasks of this team will:

- Offer correction of "water charge law" by definition water charge according final costs.
- Prepare and perform instruction schedule for WUA's in protection, utilization, surface & subsurface water resources detection in irrigation network.
- Facilitate Qazvin irrigation network evaluation during transfer years.
- Establish justify courses for WUA's during transfer years.

IRRIGATION DEVELOPMENT IN COASTAL AREA BY APPLYING DRAINAGE WATER: A CASE STUDY IN YOGYAKARTA SPECIAL PROVINCE (YSP), INDONESIA

Erwin T. Sigit[1], Sigit S. Arif[2] and Bayudono[3]

There are about to 60 km length and 1 to 1.5 km wide or about to 6000 ha of coastal land in YSR and has great potential to be developed as agribusiness area. By respecting to that phenomenon, in the early of 90's decade, several farmers who live in coastal area of Kulon Progo Regency of YSP developed some irrigated lands in these coastal sandy soil area. This area is only about to 100 to 200 m away from seashore. Development of this irrigated land was begun when farmers found that shallow groundwater has a good quality even to be used as a drinking water. Mostly, farmers use a small individual portable pump to tap the groundwater. Location of YSP is shown in Figure 1 in the Appencices.

Actually, most of farmers who developed the coastal irrigated land have another surface irrigated land nearby. However, since that surface irrigated lands are located in downstream part of irrigation system and have relatively flat topography, most of them are strongly influenced by flood during wet season and vulnerable to water shortage in dry season. By developing this coastal area, hopefully, farmers still have another opportunity to get some benefit of harvested land when these both problems occurred.

When farmers noticed that development of irrigated coastal area give good opportunity, then they develop this irrigated coastal area very intensively and extensively. Following that phenomena farmers in Bantul area, the near by regency of Kulon Progo also developed their coastal irrigated land in the late of 1990's. Even this phenomenon gave some opportunities in developing economic impact to regional development but it was worried that it will create some negative impacts to the environment in the region. The coming up of intrusion is one possibility on that.

Respecting to all of these phenomenon then the Provincial Government of YSP provide some supports to farmers relating to agricultural development of the coastal area in both Kulon Progo and Bantul regencies, respectively. This paper aims to discuss the process of delivery process of supports of Provincial Government to farmers.

1- Head of Irrigation Development Project, Yogyakarta Special Province
2- Department of Agricultural Engineering, Gadjah Mada University. Yogyakarta
3- Head of Regional Planning Board, Yogyakarta Special Province

BASIC PRINCIPALS OF DEVELOPMENT

The coastal area will be developed into integrated agribusiness development zones. Some related either sectors or institutions would be encouraged to participate and contribute significant roles in the activities. The main development strategy is utilization of all available resources optimally for various prospective activities in efficient, effective and sustainable manners. The sustainable manner means that there should be a balance between economical development, environment sustainability and human resources development.

DEVEPOMENT STRATEGY

The strategies applied in developing the area are as follow:

A. PROVISION OF RAW WATER

Water is the essential thing for development process. Instead of using individual pumping shallow groundwater, then the government support farmers by constructing reservoir. Since 1999 Yogyakarta Irrigation Project have constructed main irrigation system to supply irrigation water for about 200 hectares in the Regency of Bantul and about 217 hectares in the Regency of Kulon Progo. Scheme of coastal irrigation sysrtem isdepicted in Figure 2 in the appendices. Irrigation water will be made available by diverting from nearest resources, usually; drain or small creek to reservoirs before distributed to cultivation plots by means of piping network and series well system. Fresh water for domestic uses still apply pumped groundwater in limited volume.

B. IMPROVING MARGINAL LAND FOR DRY LAND CROP TECHNOLOGY

Sandy soil in the flat coastal area can be categorized as marginal soil since it lack of organic matter and has a very poor water holding capacity. Improving marginal condition of the soil will intensify cropping management. Low fertility sandy soil will be improved by applying organic manure and artificial fertilizers; spreading mulches on land surface will reduce high evaporation rate. Trees survived to strong and saline sea breeze will be grown near to shoreline to prevent sand dune moving to the cultivated land. Stables built adjacent to cultivation area will produce manure to raise soil fertility.

C. DEVELOPMENT IN INTEGRATED SECTORS

As there are other prospective potentials of the area, then the scope of development is not limited to only agriculture development but also inc1udes fishery (sea fishing, shrimp hatchery), tourism, home industry and others and all should be developed integrally in such a way that the maximal benefit can be obtained. Participation of university and other research center to do related research is encouraged. Improvements of sandy soil characteristic, introducing new high value crops and their post harvest technology and looking for alternative energy to be applied in agricultural development are very essential to be done.

D. DEVELOPMENT OF RURAL MICROECONOMIC SYSTEM

Lack of seed capital and low entrepreneurship are expected as the most weaknesses spots of the local community. A rural microeconomic system then will be developed in the area; rural financial institution ran by local community should be established to manage available financial resources. Training on entrepreneurship as well as introduction to market network are provided by local government staff. Training on other local potential identification and exp1oitation may also be given to local community.

E. ESTABLISHMENT AND EMPOWERMENT OF FARMERS GROUP

Prior to construction of reservoir, some researches of Gadjah Mada University and local government staff facilitated several dialog with farmers to assess farmer's development need. Dialogs were focused on what farmers need and how they could participate in development process of reservoir construction and it's operation and maintenance (O&M) works later on. In that dialog farmers delivered some critics and comments on reservoir design then the Irrigation Project improved the design accordingly.

F. GENDER PERSPECTIVE

The irrigation coastal plain area has been develops in gender perspective approach. All activities in crop cultivation are rest to woman responsibilities since sandy soil is considered relatively light to be cultivated while men go fishing and cultivate their wetland rice field.

IMPLEMENTATION OF THE DEVELOPMENT PROGRAM

The development program consist of the following projects:

A. CONSTRUCTION OF IRRIGATION INFRASTRUCTURES

Main irrigation system should be taken into highest priority, as water is the most essential to the success of the development program. The Irrigation Development Project of Yogyakarta Special Province (IDPYSP) is the one that responsible to do so and since 1999, the Project have constructed main irrigation system to supply irrigation water for about 200 hectares in the Regency of Bantul and about 217 hectares in the Regency of Kulon Prago. The construction of rest 1,580 hectares of coastal area in the Regency of Kulon Progo is postponed due to unavailable fund.

B. PLANTING WIND BARRIER TREES

To prevent cultivated land from being buried by shifting sand dunes, special trees are planted along the shoreline to form a wind barrier. This work is responsibility of Forestry and Plantation Service.

C. DEVELOPMENT OF DEMONSTRATION PLOTS AND RESEARCH CENTER

Crop cultivation on dry and sandy land would require certain technology. The Agriculture and Fishery Service join with Gadjah Mada University develop demonstration plots on dry land cropping that will also be utilized as field laboratories. Some other research center such as Technology Development and Research Agency of Ministry of Science and Technology, Institution of Agricultural Technology Development of Department of Agriculture also set up their own field laboratories in the area. Several result of researches have already been ready to be introduced to farmers.

D. ESTABLISHMENT OF RURAL ECONOMICAL ENTITIES.

Local communities should be motivated to establish rural economical entity, in any appropriate form, so that all economical needs can be accommodated. The most appropriate one is cooperative, but does not exist yet. Any other possibility to do so is Industrial and Trade Service as well as private sector organization (Local Chamber of Commerce), they may be also encourage to take a part as responsible agencies to motivate farmers as well as providing guidance to the community.

E. ESTABLISHMENT AND EMPOWERMENT OF WUA

Since this program is done by participatory approach, there are no any difficulties to impose farmers to establish farmers group, it come from their own awareness. Following completion of irrigation system, local government encourages farmers to establish water user association (WUAS) and then followed by empowerment need assessment. Actually, WUAS is very important to accommodate several works in the post construction of irrigation system and other agricultural development works. Empowerment program such as training, institution strengthening, capital provision and others, may be provided and served by local government. Researches of university have a significant role in design and implementation of empowerment program.

The IDPYSP and other related institution carry out trainings on specific substances. Among others is entrepreneurship and marketing techniques should be put in higher priority. If possible, comparative field trip to other dry land area might be taken into consideration. The IDPYSP is also responsible to strengthen WUA to actively involve in O&M activities just after set up. In the earlier WUA seems have difficulties to collect the irrigation service fee from farmers and this most likely is the most problems such as found in other areas.

F. CONSTRUCTION OTHER SUPPORTING FACILITIES

Other supporting facilities, such as: roads, tourism facilities, fishponds and others, will be constructed later on by related institutions.

G. INSTITUTION REQUIREMENT

Although related institution will responsible in implementing certain project a coordinating body is urgently needed so that all the projects can be implemented synchronously. Presently the Regional Development and Planning Service is the one that responsible to coordinate all development activities. Table 1 shows kind of development programs and their related responsible institutions.

Table 1. Development programs and the related responsible institution.

No	Institution	Development programs
1.	Regional Planning and Development Service	• Coordination body of development program
2	Dept. of Public Works and Regional Public Works Service	• Provision of irrigation infrastructures • Construction of roads and other infrastructures • Setting up and strengthening of WUAS
3	Agricultural Regional Service	• Guide the farmers on agribusiness based farming activities including choosing profitable commodities, marketing, and others. • Guide local breeders and introducing communal stable system
4.	Regional Animal Husbandry Service	• Animal Husbandry development and organic manure production program
5	Regional Fishery Service	• Irrigation Fishery • Guide farmers in fish farming and offshore
6	Regional Forestry Service	• Planting stripes of trees use for wind barrier to break off shifting sand dune
7	Regional Tourism Service	• Coastal tourism development by provision of tourism infrastructures
8	Regional Industry Service and Commerce chamber	• Guide local community in developing home industries • Guide and train on entrepreneurship and marketing

H. BUDGET REQUIREMENT

A rough calculation indicates that the development program require a total budget of Rp. 20,300,000,000.00 (twenty billiard and three hundred million rupiah). The budget of all development program cameos from several resources i.e. National Government and Provincial and regencies governments respectively. Table 2 shows the needed budget in roughly.

Table 2. The roughly needed budget of irrigation coastal area of YSR

NO	ITEM	AMOUNT (X Rp 1.000)	REMARKS
1	Construction of Main Irrigation System	12,000,000.00	
2	Agriculture Development	3,200,000.00	
3	Micro credits	3,000,000,00	
4	Survey and Investigation	500,000.00	Including agric.training
5	Training and Institution Establishment and empowerment	1,200,000.00	Roll-over credit
6	Wind Barrier	400,000.00	
	TOTAL	20,300,000.00	

Source: the IDPYSP, 1998

PRESENT CONDITION

Farmers have utilized the system for cultivating various highly value crops such as; chili, corn, cucumber, eggplant and others and get benefits from it although the crop production can be made higher if the farmers adopt appropriate cropping technology. Universities and other research center have already introduced their own result of research, such as developing micro irrigation system, introducing new varieties and crop culture, soil characteristics improvement, application of wind mill for shallow groundwater pumping and trickle irrigation purposes.

One result of development program both areas recently are known as horticulture production center and fish market. District of Bugel in Kulon Progo area is famous with melon and watermelon center production in the area, while Samas is known as one of beach tourism destination and center of onion and shallot production in YSP.

Agriculture organic culture is favorable to be implemented in the area. To do so, stables have been constructed adjacent to the cultivated land, so, farmers can easily make organic manure and directly apply it to the filed and the most important thing villages become healthier as there is no cattle stabled within villages.

The most problem found is the lack of seed capitals either for extending their on-farm irrigation system or purchasing agricultural inputs. Another one is farmers are very dependent to regional market. And they are under weak position, so, they have no power to control market price. To solve the problems the government of Bantul Regency is very often organize agricultural market day during weekend and seems it can help farmers to find good price.

CONCLUDING REMARK

Development of coastal irrigation area in YSP is one success example of collaboration programs done by several institutions. Government both national and regional levels provide fund and some support to empower people. Universities and research center introduce new technology in agricultural development and provide expertise to farmers. However, actually some difficulties very often occur. Implementation of development program by different organization is very difficult to be coordinate since all organizations have their own budget with different management. Even coordination meetings are very often done but the representative person in the meeting always different so decisions are not very easy decided.

APPENDICES

Figure 1. Location of Yogyakarta Special Province

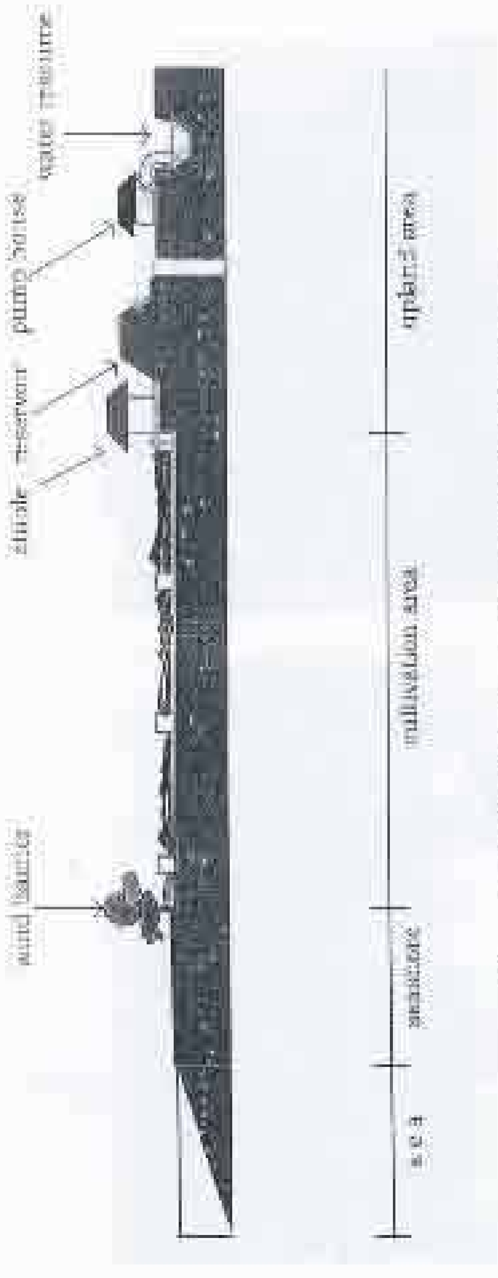


Figure 2. LAYOUT OF THE CULTIVATION OF COASTAL AREA

IRRIGATION MANAGEMENT TRANSFER TO WATER USER ORGANIZATIONS IN TURKEY

Hasan ÖZLÜ1, Öner YORULMAZ2 And Şaban Aydın AYTAÇ3

ABSTRACT

Irrigation is very significant issue in dry or semi dry regions like Turkey in order to supply adequate food production for the country. The main task is to manage properly irrigation system developed by government. Like in many countries, irrigation projects have been developed and managed by government organizations in past several decades. At the begining of 1990s, government changed the policy that might be called reform which transfers operation and maintenance responsibility of irrigation schemes to local authorities.

Up to present, Turkey developed slightly more than half of its total potential irrigable area (8.5 million ha). Taking part in the management responsibility of irrigation schemes, users organized as Water Users Organization (WUO) and took the responsibility of the management from the central government. The logic behind the transfer is to enable efficiency in terms of cost of Operation and Maintenance and higher quality of service in irrigation water distribution. This was to be achieved by the participation of water users.

This paper describes the program and assess its effectiveness from a national perspective. The assessment includes changes in staffing levels, operational costs, service fee levels and cost recovery from farmers.

Key Words: Irrigation Management Transfer, Water User Association, Participatory Irrigation Management, Monitoring and Evaluation.

1. INTRODUCTION

The purpose of this paper is to clarify the irrigation management reform conducted in Turkey during the last decade. The role of central government in the management of irrigation schemes developed by the State has changed and redefined. Users took the new roles in irrigation management. They are not only service receiver anymore but also provider. It is important to answer why users participation is required for irrigation management in state developed and managed irrigation projects. Irrigation Management

1 - Operation and Management Department Head, DSI, Turkey
2 - Agriculture Engineer, DSI, Turkey
3 - Agriculture Engineer, DSI, Turkey

Transfer (IMT) is an outcome of the government policy that it has been implemented by the State Hydraulic Works (DSI), one of the major government organizations, responsible for developing water resources in the Country. Government has changed policy in irrigation water management from central to local (users). Turkey's uneven rainfall regime necessitates irrigated agriculture. Most of the irrigation projects have been developed and managed by the government. In 1993, DSI initiated accelerated transfer of Operation and Maintenance (O&M) services of irrigation schemes to Water User Organizations (WUOs). Irrigation Management Transfer (IMT) program has become very successful and 95% of DSI built irrigation projects were transferred to WUOs up to present. WUOs performance in O&M of their systems has been considerably satisfied. Sustainability of IMT has been the main concern of the government.

2. LAND AND WATER RESOURCES

2.1. GENERAL

Turkey has settled on a large peninsula between 35-42 north latitudes and has been surrounded by the Black Sea in the north, the Mediterranean Sea in the south and the Aegean Sea in the west. Turkey has a total area of 78 million hectares (mha), of which 76.5 mha is land and the remaining 1.5 mha is water surface. The population of Turkey is about 73 million with annual growth rate of 1.5%. The share of agricultural production in GNP is estimated as about 12% of the total whereas 35% of the total population is dealing with agriculture.

The average annual precipitation (643 mm), ranges from 250 mm at the central Anatolia to over 2 500 mm at the eastern Black Sea coast in Rize province. Meteorological data show that over 96 percent of the country gets inadequate moisture during plants' growing periods. Therefore application of irrigation water is necessary over the whole country to secure agricultural production.

2.2. LAND RESOURCES

Almost one third of total area 28.0 million hectares can be clarified as cultivable land, and according to the recent available comprehensive studies an estimated 8.5 million ha is economically irrigable under the available technology. The total area under irrigation is about 5 million hectares, which includes private and public irrigation schemes (DSI and GDRS projects).

2.3. WATER RESOURCES

Turkey's hydrology is divided into 26 drainage basins. The rivers have generally irregular regimes and natural flows cannot be taken directly as usable resources. Average annual precipitation (643 mm), evaporation and surface runoff geographically vary greatly. The average annual runoff of the country is about 186.0 km^3, and the total safe yield of groundwater resources was determined to be 14 km^3 by means of comprehensive hydro-geological investigations carried out in Turkey. It is estimated that 98.0 km^3 of surface runoff and 14 km^3 of groundwater could be technically developed for consumptive purposes.

Presently, the actual consumption from surface waters is 40,1 km^3 per year. This shows that only 37.0 percent of the surface water potential has been consumed. Actual annual consumption of groundwater is 6.6 km^3. Agricultural sector is the major consumer (74%) of water where as domestic use (15%) and industrial use (11%) follow it with smaller portions.

3. IRRIGATION DEVELOPMENT

3.1. IRRIGATION DEVELOPMENT AND MANAGEMENT

Irrigation development in Turkey is carried out by both the public sector, represented by DSI and the private sector (farmers and group of farmers). There was another sister organization called General Directorate of Rural Services (GDRS) that is abolished in 2005. DSI, under the Ministry of Energy and Natural Resources (MENR), is a government organization which has been established in 1954 by law coded 6200. This and the subsequent laws authorized DSI almost all aspects of water resources development of Turkey. DSI is responsible for the execution of the following activities; to investigate, search and develop surface and groundwater resources, to construct protective structures against floods and torrents, to construct irrigation and surface drainage systems, to construct big dams and hydroelectric power generation plants, to operate and maintain dams, irrigation and drainage systems, to supply water for drinking, domestic and industrial purposes for the cities with population over 100 000.

By the end of 2006 DSI completed the construction of 591 dams and developed 2 460 000 hectares of irrigation schemes. Proportion of agricultural sector in the investment budget of DSI is about 42%, which constitutes about 850 million USD in 2005. This share has fluctuated from 30 to 55 percent in years passed.

Irrigation demands cover 74 % of the overall water consumption. The growing period for most of the crops covers the summer months June, July and August of which have almost no rain and lowest base flows on the rivers, water storage, therefore, is indispensable. Currently, 591 storage facilities (large and small dams) developed by DSI are in operation. About 70 % of the irrigation projects use the water supplied by reservoirs and regulated natural lakes.

Table 1: Development achieved so far, as of end of 2006 is as follows:

Potential for Irrigation Projects	8 500 000 ha
Projects in Operation	4 565 033 ha (net)
DSI	2 527 502 ha
GDRS(abolished in 2006)	1 037 531 ha
Farmers	1 000 000 ha
Projects under Construction	650 000 ha

On public schemes, the national average of the irrigation ratio (the part of the equipped area actually irrigated) varies by years between 60 and 70 % with wide regional fluctuations. DSI and GDRS have jointly developed about 434 120 ha groundwater irrigation projects. DSI drill the wells, install the pumps and set the power transmission lines while GDRS constructs the irrigation canals or pipes.

4. IRRIGATION MANAGEMENT TRANSFER

4.1. BACKGROUND OF TRANSFER OF IRRIGATION SCHEMES IN TURKEY

Since 1954, Turkey has had a legal framework allowing the transfer of management responsibility for public constructed irrigation schemes to local control irrigation management by the Government. At the early sixties some small-scale irrigation schemes, which were isolated and far from the administrative units of DSI, had initially transferred to users with different approach from the Participatory Irrigation Management (PIM) concept we perceived today.

Before the accelerated transfer program was commenced, Irrigation Communities (IC) had been working at DSI managed irrigation schemes, which was accounted for 40 % of command area. Before 1993, DSI’s policy focused on transferring only small and isolated schemes, the management of which was difficult and uneconomical. Until 1993, small schemes total area of which was about 50 000 ha were gradually transferred to users. DSI's policy shifted from transferring only small and isolated schemes to an accelerated approach of transferring large-scale irrigation system as well as small and isolated ones.

In 1993, pilot transfer program was implemented effectively for transferring the irrigation schemes in the regions that ICs had already been existed and worked efficiently, Antalya, Adana, Konya and Izmir regions, where DSI officials had shown a higher level of preparation and dedication and farmers were more receptive. At initial, overseas training program including Mexico and USA for DSI senior staff had great contribution as well as internal training program, including seminars and workshops for DSI and water users. The main underlying reason for accelerating transfer program has been the operation and maintenance financial burden for DSI and the Government, which was getting unsustainable. The operation and maintenance cost recovery (rate of collection of water fees), has been unsatisfactory (about 40%). The present Government's general policy of promoting local control was also a contributing factor.

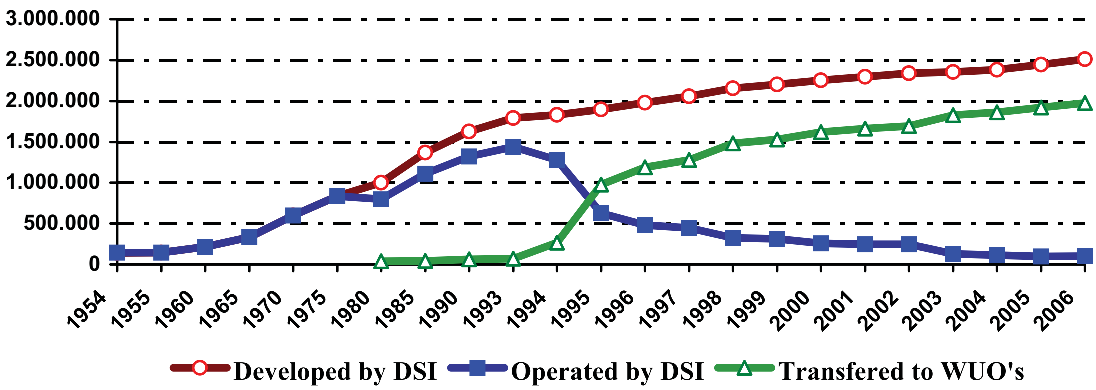
4.2. PRESENT STATUS OF IRRIGATION MANAGEMENT TRANSFER

At present, O&M responsibility of about 1.92 million hectares have been transferred (95%) to water users organizations established in several different forms. Transfer is not restricted to a single type of user organization. Based on the user's preference and size of the related schemes, irrigation systems have been transferred to WUOs such as Water Users Associations (WUA), municipalities, village authorities and cooperatives.

Table2: Organizational Distribution of Transferred Irrigation Schemes

ORGANIZATIONS	No's	Rate (%)	Area (ha)	Rate (%)
Village authority	227	27,9	39 302	2.0
Municipality	152	118,7	66 157	3.3
WUA	343	42,1	1 786 405	90.4
Cooperatives	88	10,8	83 080	4,2
Others	5	0.6	1 150	0.1
TOTAL	**815**	**100**	**1 976 094**	**100**

Graphic: Transfer Progressing



4.3. BENEFITS OF TRANSFER

In the 2006 Human Development Report, It is expressed that “One of the most influential institutional changes in governance in recent years has been the introduction of participatory irrigation management and the development of water user associations. In the best cases—as in Indonesia, Mexico and Turkey—institutional reforms have transferred management to irrigation users, with marked increases in revenue collection, maintenance spending and irrigation returns. *The lesson: where producers have more authority and responsibility for water management, transparency can improve pricing, cost-recovery and performance*.”

a. Participation of Users and Self Management

Economic and technical efficiency of irrigation systems can be attained by developing a concept which can be formulized as "sense of ownership”. A successful transfer should encourage water users to operate and maintain their systems through assigning them as stakeholders and through making these services without free of charge. This approach will in turn provide water security and sustainability. Water users constitute the major portion of the agricultural population (40%) in Turkey. In the past, because of the social pressure, their responsibility to join the irrigation management in the schemes developed by DSI was negligible. Turnover process has provided beneficiaries to take part in the governance such as electing their own board members and the management, determining the water charges to be collected. DSI has transferred the responsibility of O&M not only the tertiary and secondary but also main canal of the irrigation schemes in order to strengthen user responsibility. IMT created a self-control both adequacy and quality of services supplied by WUA and control of budget with respect to revenue and expenditures.

The picture is quite different after the IMT, same farmer now does not dare to ask or demand water out of his schedule and feels like using water more efficiently to avoid paying high electricity cost in pumped irrigation. Damages to irrigation structures could not be recovered due to failure of finding the offender. Now, with the PIM all the users feel obliged to safeguard the facilities and easily catch the offender. The person who causes damage pays normal cost of that damage before he is asked. Otherwise he pays fine which accounts for about 4 to 10 times more than that of the cost.

b. Good Governance

By transfer, WUA management consisted of chairman and WUA board become accountable for WUA assembly convenes three times in a year where quality of irrigation scheme performance with respect to equitable water distribution, water use efficiency and upkeep of project facilities as well as budgetary control are discussed. Satisfactory performance of the WUA management and transparency are prerequisites for the next board election. This constitutes true self-control of WUAs at a democratic level. Water users are now well organized. They establish their own organization by and manage it themselves. Instead of individual demand of user WUA managers make their requests from government institutions on behalf of WUA. This make easier to meet the demand for both government and users. Farmers, accounted for about 33 percent of the employment in the country, have had the right and responsibility to join the irrigation management such as choosing the manager, water charges to be implemented, making a decision on system management with the participatory irrigation management. In transferred pump irrigations, users are very sensitive in running the pumps and using the water for irrigation.

c. Financial Sustainability

WUAs self-financing and budgetary control provides flexibility in finding better solutions to operate and maintain and further improvement of the system. Financing normal operations is accomplished by charging water users an irrigation fee related to the area irrigated. Several types of charging have been used, a seasonal flat rate per hectare, a pay per-irrigation and time and volumetric basis systems. WUAs must account for their financial dealings to the membership. Presently, there are routine financial transactions between the WUAs and DSI for cost recovery of investment.

d. Decreasing O&M Cost and Increasing Collection Rate

Operation and maintenance cost of government decreased with transfer. The number of operation and maintenance Staff of DSI decreased about 69%. At present staff intensity (person/10 000 ha) of WUAs is 23 and DSI O&M staff intensity 20. Considering the total staff intesity of O&M services we can conclude that that is 43. This was 74 in 1993 before the IMT. After the IMT, staff efficiency increased 58%. Labor cost of DSI is considerably higher than that of WUOs because of unionized labor at DSI whereas WUOs pay minimum wage and employ seasonal labor when needed. This lower labor cost results in lower operation cost. Efficiency of seasonal labor employed by WUOs has been highly satisfied. WUOs collection ratio (83%) of water charges has doubled.

5. PROBLEMS FACED BEFORE AND AFTER TRANSFER

There were experiences in transferring small scale and individual irrigation projects which are isolated and far from management unit of DSI. Besides this these projects were serving to only one village or small town. But in this case large irrigation schemes are subject to transfer to users. It was a big challenge that government has transferred management of irrigation projects without considering how large they are. How can users manage these large irrigation areas without having any help from government? There was a great suspicion on loosing jobs for DSI's staff after the transfer. Some old projects needed rehabilitation may not be easy to operate for users. WUOs were newly established and they needed training, technical guidance and capacity building on the management of the irrigation system.

Technical guidance and training needs of WUOs have been met by DSI and will be met in the future. However those trained technical staff of WUOs is not to be sustainable because of lower wage and not having of work guarantee. This makes WUOs employ new technical staff for managing the irrigation system. Nobody lost his job because of transfer of irrigation management in DSI. DSI is such a large organization that staff have been moved to another department such as planning, design and construction or retired voluntarily and employ elsewhere.

Aging problem for O&M Department because of not recruiting new staff for O&M services seems to be one of serious problems. By the time DSI may lose its O&M experience and be weaken. Although policies for the rehabilitation and modernization have been defined as participatory approach, Government sould develop an action plan for the long run. Role of the O&M Department is to be modified for sustaining O&M services in the long run and necessary measurements have to be taken. WUAs can be organized as Irrigation Federation because they need this organizational structure in order to increase their capacity for O&M. This requires legal arrangement that has been drafted.

In order to mainly meet the needs of machinery and equipment of WUOs, a project named Participatory Privatization of Irrigation Management and Investment Project (PPIMIP) was commenced by DSI with support of World Bank in 1998.

5.1. A PROJECT IMPLEMENTED (1998-2004) TO SUSTAIN IMT

Participatory Privatization of Irrigation Management and Investment Project (PPIMIP - Loan 4235)

DSI wanted to help meeting the urgent equipment needs of WUOs, which have been recently and rapidly established and took over the operation and maintenance (O&M) responsibilities from DSI, starting from 1993, for uninterrupted and successful O&M

activities. At the same time, GDRS (abolished in 2005) wanted to initiate changing its traditional investment policies that fully subsidized by the Government, as well as to help modernization of classical irrigation systems, operated by WUOs. Therefore, both state agencies DSI and GDRS, which are responsible for irrigation investments in Turkey, decided to implement this project, financed by the World Bank and executed by DSI, GDRS and WUOs (Water User Organizations = Water User Associations, Irrigation Cooperatives etc.).

Out of those, 308 WUOs, commanding an irrigated area of 1.59 million ha, have actually benefited from this component through the purchase of 567 pieces of heavy equipment (graders, excavators, loaders, tractors, etc.), and 3,204 pieces of small equipment (pumps, computers, motorcycles, etc.) at a total cost of about USD 36,5 million. The beneficiaries contributed more than 63 percent of that total cost, the remaining part being financed under the Project.

Under Pilot Rehabilitation Program component introduced with the amendment dated June 2001, investment activities have been implemented under contracts to be financed on a 50 percent basis by the loan and 50 percent contributions by the participating WUOs. Sixteen WUAs have participated in the pilot with rehabilitation contracts of about USD 3,800,000. These are the first examples in the country that have done substantial rehabilitation with large financial contributions from the members. These experiences have increased the interest among members of the WUOs and improved the trust between WUO management and members.

6. TRAINING

Since 1994, DSI have organized several training programs in order to increase capacity building of WUOs. A total number of 1 212 staff of WUOs has been trained. 519 engineer, 408 accountants, 285 pump operators participated those programs organized in different times and years in local or national level. In addition to these, in the year 2000 and 2003 a three-day seminar was organized for the Chairmen of WUAs and Cooperatives to discuss over all issues. A follow up seminar was organized at national level for the Chairmen of WUAs and Cooperatives in May 2004.

7. RESULTS OF MONITORING AND EVALUATION

Monitoring and Evaluation (M&E) studies have been carried out by O&M Department of DSI. WUOs have generally demonstrated the ability to operate and maintain the system satisfactorily, specifically setting up balance and equity in water distribution. Some findings from M&E study as average for 2006 are given below:

1. Irrigation ratio in transferred irrigation schemes and DSI managed were 61 % and 24 % respectively.

2. Irrigation efficiency was 41% when irrigation schemes were being managed by DSI, after transferring this ratio increased to 43%.

3. Power consumption of pump irrigation schemes decreased about 20 % after the transfer.

4. By transfer, the number of DSI's O&M staff declined about 69 % and it will continue to go down until it reaches a certain number.

5- WUAs have an average water charges US$ 99.85 per hectare. Expenditures are operation cost US$ 52.3, and maintenance cost US$24. For DSI, average water charges 157 US$ per hectare, operation cost US$ 83,2 and maintenance cost US$ 73.8 per hectare.

6. Collection rates of water charges are recorded about 26 % and 85% for DSI and WUOs, respectively.

7. Total budget of WUOs amounted 245 Million YTL (180 million USD) in 2006.

8. In 2006, expenditures of WUOs are 58% for operation, 28 % for maintenance-repair and 14% for others.

9. Technical managers of WUOs are usually agricultural engineers (71 %).

Those performance indicators given above show that WUOs have performed quite well comparing to the government managed ones.

8. WHAT IS NEXT FOR SUSTAINING OF WUA?

The following measurements should be taken to sustain IMT:

1. Flexibility should be given to WUOs in order to achieve their required and needed structural changes by new Irrigation Associations Law.

2. Given training, technical assistance and guidance by DSI to WUOs should continue until they get adequate experience in irrigation management.

3. In a transferred irrigation area, modernization and rehabilitation of irrigation system or network on cost sharing basis, should be given priority by the government. It was implemented with Pilot Rehabilitation Program (PRP) that is a sub component of PPIMIP.

4. As a matter of fact, a huge portion of the budget only covers the electricity cost in pump irrigation. In order to provide sustainability of transferred pump irrigations, water charges should be determined realistically, irrigation ratio should be increased and irrigation methods should be replaced with efficient ones by WUOs. Price of electricity used in pump irrigation should be kept modest. Otherwise it may not be possible to compete with surface irrigation.

5. To change stakeholders' (users, politicians, technicians, farmers) mentality expecting full support from government is highly difficult handicap to be exceeded. Providing a close collaboration, information exchange among stakeholders and organizing training programs to train them are needed.

6. WUOs should set their fees (tariff) realistically in order to balance with their expenditures of operation, maintenance, energy and equipment purchase.

7. If a large irrigation project is required to transfer to a number of WUOs, command areas of each one should be kept larger as much as possible.

8. DSI is monitoring and controlling the activities of WUOs but has not enough power of sanction for WUOs to fulfill operation and maintenance deficiencies in proper time with enough budget.

9. Shortcomings of WUO O&M services should be accountable for DSI. This topic can be surmounted by legislation proceeded.

10. Agricultural extension services have to be intensified in order to shift farmer's customary habits, to tell the latest development in the sector and agricultural policy and outdated farming practices, which hinder improvement of irrigated agriculture and reduce efficiency of the project.

11. Encourage users in participation of WUA management in order to create competitive environment.

12. Close contact of O&M staff with WUAs in the field should be kept alive to sustain O&M activities properly.

9. CONCLUSIONS

The Turkish Irrigation Management Transfer Program remains impressive. Begun in 1993, the program has now shifted 95% of the large-scale irrigation in the country to local management. The primary driver for the change was labor costs which spiraled out of control in the late 1980s and early 1990s, starving the agency of funds to maintain irrigation and drainage facilities. Staffing intensity on WUA-managed schemes is only about 58% of that prevailing when DSI was the sole managing entity, showing strong gains in operational efficiency from the transfer program. For DSI, the transfer program has resulted in significant declines in its own O&M staff levels (69%), principally affecting unionized skilled and unskilled labor.

DSI operating costs have also fallen sharply. However, per hectare operating costs on the 5% of schemes still managed by DSI are 59,2 % more than those on WUA-managed schemes. Existing schemes remaining under DSI control are proving difficult to transfer completely to local control for a variety of reasons.

WUAs are currently (2005) charging about US$ 88,35 per hectare irrigation fees. DSI charges (US$ 157) about 78 % more than this in nominal terms, but collects for less. In 2006 WUAs succeeded in collecting 85% of the amounts due to them from water users. DSI collected about 26% of its collectibles at rates effectively much lover than WUA rates.

DSI changed design policy in 2003 from open canal to piped system. This will make a number of benefits for both government and users as well as changing irrigation techniques. Considering operation and maintenance activities, users will replace their irrigation method from traditional surface to sprinkler and drip. Besides farmers, WUAs have to learn and apply new rules and techniques with in their modern irrigation networks. Of course training programs with the projects are implemented but additional ones required both DSI and WUAs.

REFERENCES

1. Bilen Ozden, Uskay Savas ; "Background Report on Comprehensive Water Resources Management Policies, An Analysis of Turkish Experience", The Worldbank International Workshop , Washington D.C., June 1991
2. Erdogan Faruk Cenap, Doker Ergün; 'Participatory Irrigation Management Activities and Water User Organization in Turkey', National Irrigation Congress,08-11 November, 2001, Antalya.
3. "Environmental Performance Reviews- Turkey", OECD Publications, 1999 DSI Publications and Statistics
4. Uskay Savas; "Successful Experience of Turkey in Participatory Irrigation Management to Users." Euro- Mediterranean Conference on Local Water Management, Marseilles, November 1996
5. "Expert Assessment Reports of Water and Land Resources in Turkey" for the Seventh Five Year Development Plan 1996-2000,State Planning Organization, Ankara
6. PCU, (1998-2000). A Monthly and Annual Progress Reports of Participatory Privatization of Irrigation Management and Investment Project. Ankara, TURKEY.
7. World Bank, (1997). Loan Agreement Number 4235 TU, "Participatory' Privatization of Irrigation Management and Investment Project", published by Turkish Official Gazette, dated 27 Feb., 1998. Ankara, TURKEY.
8. World Bank, (1997). Staff Appraisal Report, No, 16525-TU. Rural Development and Environment Sector. Washington, USA.
9. ÖZLÜ Hasan, Participatory Irrigation Management (PIM) and Irrigation Management Transfer (IMT) Activities in Turkey, A Follow-up Seminar On TOWARDS A SUSTAINABLE AGRICULTURAL DEVELOPMENT: NEW APPROACHES, 15-21 April,2002 Antalya, TURKEY
10. ÖZLÜ Hasan, "Irrigation Management Transfer (IMT) in Turkey", 9th National ICID Symposium on Local Water Management in (Semi-) Arid Irrigated Areas, Institutionalizing Participation of Water Users in System Operation, Maintenance, Development and Financing, March 25, 2004, Arnhem, Holland.
11. SVENDSEN MARK & MURRAY-RUST D. HAMMOND, Creating and Consolidating Locally managed Irrigation in Turkey: The National Perspective (2001)
12. UNITED NATIONS DEVELOPMENT PROGRAMME (UNDP), Human Development Report 2006

The 4th Asian Regional Conference &
10th International Seminar on
Participatory Irrigation Management

Tehran-Iran 2-5 May, 2007

Theme 2

Required Grounds and Facilities for PIM Formation

GHAZVIN IRRIGATION SYSTEM
CONSTRAINS & DIFFICULTIES – PRACTICAL SOLUTIONS

Ebrahim Kahrizi[1], Mirkazem Razavi[2]

ABSTRACT

As a result of carrying out the Ghazvin Development Project (GDP), aiming Agricultural and Rural development in an area of 80,000 ha. in a period of three decades (1960, 1970 and 1980), Ghazvin irrigation system consisting of 1053km (including the main, secondary, tertiary, quaternary canals and the pertinent structures) have been constructed and operated. Since 1993, the management, operation and maintenance (O & M) responsibilities of the above system have been assigned to the "Ghazvin Irrigation System Operation Company" (GISOC). Now a region in a nearly 60,000 ha net area with nearly 30,000 water users and an annually 630 mm^3 irrigation water is under the service of the Ghazvin Irrigation System (GIS).

The public and semi-public managements over the system in a period of nearly three decades, have caused unexpected difficulties, deficiencies and constrains in the system.

Recently the Ministry of Energy (MOE) planned to study the rehabilitation of the system and its relevant management, which was assigned to Pandam Consulting Engineers.

Based on the above mentioned study and findings, advices and solutions have been proposed for rehabilitation of the system and improvement of the irrigation management, and irrigation management transfer (IMT) to water users' organizations as well and settle the participatory irrigation management based on the proposed solutions.

Key words: Farmer-participation, participatory Rural Appraisal, Rehabilitation, Irrigation Management Transfer, Water Users' Associations, Rural Development, Agricultural Development, Stakeholders.

1- Project Manager and Senior Engineer in Water Resources Management Pandam Consulting Engs.
2- Senior Engineer in Water Resources Management Pandam Consulting Engs. and Member of Iranian National Committee on Irrigation and Drainage (IRNCID).

INTRODUCTION

Rural and agricultural development are indication of economical development in every country. Achievement of such development requires in addition to other necessary conditions and facilities, is to supply and distribute sustainable water which should conform the needed water of plants in one hand, and the effective and informed participation of farmers in the process of decision making, planning, compiling of projects and carrying out thereof, the management, operation, maintenance and monitoring and evaluation of concerned activities as well, on the other hand.

GDP aiming the following activities was carried out following the destructions and damages of 1962 earthquake:

- Integrated agricultural development in Ghazvin area, based on local water resources development and conveyance of Taleghan river's water to the Ghazvin area as a complementary irrigation water;
- As a practical pattern, examining the outcomes and findings derived from execution of the project in the other areas of Iran;
- Training experts in land and water development for the development of the other areas of Iran;
- Increasing the efficiency of the crops and promoting the living standards of the farmers in Ghazvin area, supplying the food shortages of Tehran metropolitan as well.

Although the construction of the dams and irrigation system and water conveyance to the Ghazvin area have brought about the growing up in agricultural products and relative increase in the farmers' welfare, but the expected sustainable development aimed in the GDP has not been achieved, and at the present time, the Ghazvin Irrigation System (GIS) confronts the physical and management problems.

This article examines the causes of incomplete achievement of expected aims, the main reasons thereof, and also the workable and practical solutions for improvement based on the findings of recent overall studies, will be discussed.

LOCATION

The Ghazvin area locates in 150 km west of metropolitan city of Tehran, as the Tehran-Tabriz express way and railroad cross the area, it has given the area a particular situation.

IRRIGATION MANAGEMENT IN GHAZVIN AREA

BACKGROUND

Prior to performing the GDP, the irrigation management was governed by Land and Tenant (Feudal) System, where the irrigation management (IM) had being organized and supervised by the landlords and their agents and it was beyond of farmers' (tenants') authority. The main agricultural production means (land, water, seeds and tools) belonged to landlords as well. Following the enforcement of the Land Reform Act in 1963, all those mentioned agricultural means were transferred to the farmers, and along with (thanks to) carrying out the GDP, the landlords (feudal) were substituted by the government (public section), and then verified as a completely public agency. In order to make the GDP executional, based on findings and planned aims, two organizations were established:

Ghazvin Area Reclamation Organization (GARO) in charge of agricultural development and Ghazvin Area Irrigation Project (GAIP) as responsible for supplying, conveyance and distribution of needed water and also construction of irrigation system and related structures. The main components of the GAIP are as follows:

- Taleghan dam
- Sangban diversion dam
- Taleghan water conveyance tunnel
- Ziaran diversion dam
- Irrigation system
- Deep wells for ground water exploitation
- Artificial recharge establishments.

The water diversion structures of Taleghan including Sangban and Ziaran diversion dams and conveyance tunnel were constructed in a period of 4 years (1970-1974). The length of tunnel is about 9 km in a diameter of 3.6m and capacity of 30m^3/sec. The construction of irrigation system started in 1974 and completed in 1997 with a nearly 17 years behind the planned schedule.

The Taleghan storage dam construction in a total capacity of 450 mm^3 was constructed in a 46 months period since 2000, with a delay of two decades comparing to initial scheduled period, and it is under operation.

Based on planned operation schedule, the annually allocated water for irrigation of the Ghazvin area is 279 mm^3 and 20 mm^3 for artificial recharge (usually in non irrigation season) and 150 mm^3 to be conveyed to Tehran metropolitan as a partial supplying of needed domestic water and 12 mm^3 for down stream water rights and sustaining the environment requirements.

Out of 425 ha. designed for the ground water artificial recharge, only 135 ha is implemented and under operation, the remaining designed part is planned to be carried out as an important section of the project. The general specifications of Ghazvin irrigation system are as follows:

- The total gross project area: 80,000 ha.
- The concrete main canal (feeder canal), 94.3 km in length with a capacity of 30-3 m^3/sec and concrete lined.
- Concrete lined laterals (L), in a length of 214.7 km and capacity of 600-7900 lit/sec.
- Concrete lined tertiary canals, in a length of 262 km and capacity of 170-1000 lit/sec.
- Concrete lined quaternary canals (irrigation ditches), in a length of 481.9 km and capacity of 170-340 lit/sec.

ACCESSIBLE WATER RESOURCES

Irrigation water requirements has been supplied from two combined surface and ground water sources as indicated in following table:

(In mm^3 annually)

Source of water	Initially planned	Mean annually used water in past 3 decodes	Future potentially available water from Taleghan reservoir in normal condition
Conveyed surface water from Taleghan	279	142.2	279
Conveyed surface water from Taleghan for artificial recharge	60	19.8	20
Exploited ground water (for irrigation, domestic and industrial uses)	194.4	433.8(1)	334.5
Local streams (mainly intermittent streams)	6.7	16.0	16.0
Total	480.1	611.8	629.5

1) Based on accessed data in 2003 it amounts to 463 and on last 5 years' mean it amounts to 430 mm^3 annually

The irrigation system initially was managed by the Ghazvin Area Irrigation Project, and since 1993, the Management, Operation and Maintenance (MO&M) is being implemented by Ghazvin Area Irrigation Operation Company (GAIOC). The GAIP was quite a governmental organization and GAIOC is affiliated to Ministry of Energy (MOE), and performs its assignments under supervision and according to MOE's regulations and policies.

The GAIOC established in 1991 but has been acting the management, operation and maintenance (MO&M) since 1993.

The main objects of GAIOC's establishments are as follows:

- Improvement of the irrigation system;
- Promotion the communication system between the water users and water resources management authorities;
- Increasing the irrigation efficiency, the water conveyance part in particular;
- Reducing the governmental costs;
- Improvement of agricultural water using system aiming the optimization of water using system;
- Making beneficial use of hydraulic structures and available equipments in irrigation systems.

- Improvement of the government's organizational structure and reducing the number of the engaged personnel;
- Preserving the governments' rights through timely collection of delivered water revenues, which might be achieved by company's more endeavors;
- Providing possible performance of MOE's policies including volumetric delivery of water;
- Extension of participation acception of water users in conservation of irrigation system.

- SHAREHOLDERS OF GAIOC:

- MOE holding privileged shares (49%)
- Saveh and Tehran province irrigation management companies holding 25% and 26% of shares respectly. Governmental management on irrigation system for a nearly 3 decades has caused serious difficulties and deficiencies.

- LAND EXPLOITATION SYSTEMS IN GHAZVIN AREA

Agricultural land exploitation systems in Ghazvin area has been established as absolute property, lease holding (tenancy), crop sharing and joint sharing, which in terms of percentage are conforming to 57.7%, 19.8%, 3.7% and 0.7% respectively.

THE EXISTING CONSTRAINTS IN FUNCTIONING OF THE PRESENT OVERALL MANAGEMENT OF THE GIS.

- A considerable part of the irrigation system is demolished or worn out;
- The basic factors for required water estimation and water allocation have nearly unchanged. During around the past 3 decades, the same applies to operation of the irrigation system;
- Irrigation efficiency is low and has a descending trend;
- The maintenance of the system is not carried out correctly;
- The water users are not participation in irrigation management;
- Existing farmers organizations (associations, unions and provincial associations) are participating only in water distribution and partial maintenance of the system;
- There are inconformities in management of combined uses of surface and ground water;
- In spite of volumetric delivery of water, the measurement hydraulic structures are not enough calibrated.
- As the irrigation structures and service roads are deteriorated, their required efficiency has diminished.

PARTICIPATION OF WATER USERS' IN IRRIGATION MANAGEMENT, THE RELEVANT TAKEN MEASURES

Along with the enforcement of the state's privatization policy and decreasing its dominated management on irrigation as well, in the 2005, in order to establish the water users' organizations in GA, aiming the improvement of the irrigation system's management, and in some occasion for IMT from state to water users, measures have been taken, of which, the most recognized ones are as follows:

- In late 1998 as a pilot, in one of the laterals (L2), 12 water users' cooperatives were established and registered, and in early 1999 their relevant union was established.

  The idea was to transfer the irrigation management of L2 to the mentioned cooperatives, assuming, in case of successful achievement, it would applied to the whole area i.e. management, operation and maintenance of the irrigation system might be assigned to the water users' established cooperatives.

  The above mentioned cooperatives were disorganized in 2001, some of evidences which caused non achievement of the expected objects are:

  - Not award and voluntarily attendance of farmers in organizing the cooperatives;
  - Lack of support and non achievement of promised support already rendered by in charged public sections.
  - Lack of verified liabilities and authorities.

- In early 2002, subsequent efforts aiming the establishment of WUOs started in all over the area, and as a result, in 2005, 158 so called "anjoman haay-e senfy" or guild association of water users and their 8 related so called "Ettehadieh" or union and one so called "Kanoon-e-Markazy-e-Anjoman haay-e Senfy-e Kar farmaee Abyary-e ostan-e Ghazvin" or the provincial association of Ghazvin province were established.

  These WUAs are functioning based on an agreement with GISOC and their liability are limited to irrigation water distribution and a small portion of maintenance of the system.

DAMAGES AND LOSSES

Although the establishment of WUAs but not their sufficient participation in MO&M process during last 18 months relatively improved their capability in following up their requirement and promoted the WUAs' encouragement; and also have made them subject to some organization and authorities, but for the time being, the WUAs are confronting constraints and challenges as follows:

1- The establishment of WUAs has not been formed according their will, not based on their requirements, and not performed by the farmers.

2- The selected legal structures for the mentioned organizations are not compatible to the nature of the farmers' activities and necessities. They have been formed and registered according to the Labor Act and Criteria for organizations called society, union and association which verifies the laboring environment instead of introducing the agricultural WUAs' and its necessities.

3- The established organizations are not recognized as legal entities (corporate bodies) and are not supported by the administrative affiliated to the Ministry of Energy and Ministry of Jahad Agriculture (MOJA).

4- These organizations have not been assumed as participating in decision making in the process of management, operation and maintenance of irrigation system, and as a sub-contractor, they partially carry out the assignments and liabilities of the GISOC.

5- The established organizations are not financially, technically and administratively capable and are not independent in decision making for irrigation management.

6- Among the assigned forms for the recently established organizations only the title of "irrigation association" conforms the Labor Act, but two other forms (union and guild association) are not verified in Labor Act. There are no definitions for (Irrigation Union or Guild Association) in Labor Act.

INFLUENCING CAUSES OF CREATED CONSTRAINTS AND INSUFFICIENCIES

1- Non participation of farmers in irrigation management as a result of the public section's management.

2- Lack of coordination among the relevant organizations and administrative of public section (stakeholders).

3- Lack of a clarified strategy for IMT to the farmers.

4- Existing a general tendency of decision making and personnel of relevant public section in imposing their evident or hidden ideas, methods and objects on the farmers.

The dominant public section's management on the Ghazvin Irrigation System has carried out its plans and designs for the improvement of the irrigation system, without a fundamental reform in existing relevant organizations, without taking into consideration the local society's desired needs, and in lack of providing required facilities for participation of the farmers. Such an approach[1] and circumstances caused deficiencies and some mismanagements in establishing the above mentioned organizations as well as the participation of the water users in the process of MO&M of Ghazvin irrigation system, which resulted in existing undesirable condition and inefficiency of Ghazvin irrigation system.

SOLUTIONS AND EXECUTIVE REMEDIES

A- SOLUTIONS:

- Reforming the existing GISOC organizational structure to a private company;

1- The irrigation agency's staff (the government), mostly are incompatible with the nature and the approach of participatory management, and having a long term link to bureaucratic formalities, which in many cases revealed as problem against participatory management.

- Reforming the existing water users Guild Association (WUGA) into private GIOC (private joint stock company),
- Reforming the legal structure of existing guild associations as water users associations (WUAs);
- Transfer GISOC's shares to WUAs;
- Distribution of WUA's shares among the entitled members;
- Providing necessary conditions, sources and facilities in Ghazvin Regional Water Company (GRWC) and Ghazvin Jahad Agriculture organization (GJAO); for supervision, guiding, supporting the WUAs' and to pursue all their related issues.

B- EXECUTIVE REMEDIES:

- Transferring 51 percent of existing GISOC private shares to WUAs.
- In this stage, following the administration formalities and the agreement of private shareholders, 51% of GISOC's private shares of the company have to be transferred to WUAs.
- Changing the privileged shares of GISOC (49 percent of MOE's shares) into ordinary shares;
- After drawing up the formal process-verbals and necessary documents for transferring the shares, and performing the official formalities, 3 members of GISOC board should be selected by WUAs, and then, the company's managing director should be appointed by the board.
- Thereafter, the company and its new elected board of directors as a corporate body with a reliable legal standing is assumed liable to its commitments raised from irrigation managements transferred by the GRWC.
- A competent consulting engineers might cooperate the GRWC along the above mentioned process and will make required supervisions and services.
- The mentioned remained 49 percent public agency (MOE) owned shares have to be transferred to the WUAs by concerned public organizations (MOE, privatization organization, etc…).
- Making necessary rearrangements in the company's board; hereinafter, all members of the board are being elected by WUAs and all WUAs members are assumed as shareholders of the private joint stock company.

C- MEASURES WHICH HAVE TO BE TAKEN BY PUBLIC RELATED AGENCIES ALONG WITH TRANSFERRING THE COMPANY'S SHARES TO WUAS:

- Establishment of "coordination & arrangement" & "supervision" sections for WUAs' affairs and issues in GRWC;
- Establishment of a "coordination and arrangement" section for WUAs' affairs and issues in Ghazvin Jahad Agriculture Organization (GJAO);
- Providing the cadastral maps;

- Taking preparation measures of the farmers to change the existing flow (gravity) irrigation method in quaternary canals (head ditches) into pressurized irrigation method as the pressurized irrigation development in the area;

D- FORECASTS AND MEASURES WHICH HAVE TO BE TAKEN FOR ACHIEVING DESIRABLE MANAGEMENT, MAINTENANCE AND SUSTAINABLE OPERATION OF THE IRRIGATION SYSTEM:

- Establishing the Information System;
- Establishing the Monitoring and Evaluation System;
- Relevant legal, financial and administrative training of WUAs' staff;
- Verifying the needed financial sources including:
  - Water price
  - The government subsidies
  - Low rate or without interest loans
  - Other possible sources
- Technical and financial audit of WUAs' financial operation performance by an independent auditor.

PREREQUISITES AND PRIMARY ACTIONS FOR ACHIEVING THE PLANNED OBJECTS

A: CAPACITY DEVELOPMENT AND MOBILIZATION OF THE INVOLVED PUBLIC ORGANIZATIONS (GRWC-GJAO), WORKS TO BE CARRIED OUT:

- Holding discussion and exchange of views participated by involved officials and experts while benefiting from methods and techniques of Participatory Approach.
- Establishment of "coordination and arrangement" sections for WUAs' affairs in both above mentioned organizations;
- Establishment of "supervision" section related to WUAs;
- Appointment of "WUAs' empowerment executive group" composed of delegates from GRWC, GJAO, WUAs, each member of the group will attend based on needed expertise;
- Arrangement of executive plan for the empowerment of WUAs;
- Introducing central group members for supervision over executive group.

The GRWC is liable for setting up the workshop, the required engineering service will be provided by consulting engineers.

B: CAPACITY DEVELOPMENT AND EMPOWERING THE FARMERS:

- The activities related to empowerment of the farmers are mainly:

- Holding training workshops for WUAs' board members and WUAs' members as well, in these workshops they will be acquainted with exercising methods and know how of Participatory Rural Appraisal (PRA) among the others, preparation of social and natural resources' maps, Venn diagram, seasonal calendar, problem tree, their related impacts and conclusions and problem solutions, and also verifying activities, designing the executive plans, consequently while they acquiring precise information about the irrigation system, will be able to attain skills of negotiation, convincing and to be convinced, data collection and data analysis, to feel responsible and liable, decision making, respecting each other and participating in joint activities and they will be prepared for achieving the objects and designed plans.

Some of objects or expected conclusions of capacity development and empowerment of farmers are:

- Farmers have to be organized in a manner that they might be able to perform the maintenance and rehabilitation of the irrigation system without receiving any contribution (help) from the government;
- The board of directors of WUAs to achieve enough skill in settlement of disputes raised among the farmers;
- Preventing financial disorders and corruption which might appear after IMT;
- To improve WUAs' reliability, i.e. to improve the capacity and ability of WUAs for confidence and honesty making that the applied policies for leading the irrigation management is compatible with farmers' common requirements;
- Increasing savings by water users as a security for long period sustainability of irrigation system, the farmers, generally are reluctant in long term investment for non clarified objects, applying participatory methods and planning and carrying out the empowerment programs, desired backgrounds for the above purpose might be provided.

- Participation of farmers in rehabilitation of the irrigation system (IS):

  - In case of securing the rehabilitation of the IS prior to IMT, it helps to strengthen the idea of ownership of the system by the government, and the farmers will keep in their mind that the government will bear the rehabilitation's future costs.
  - In the event of rehabilitation prior to IMT, because of possible financial deficiencies and time consuming administration formalities, it might postpone the IMT process, which could discourage the involved local agencies to participate effectively, in addition to that , a long term reform might make the elongated process subject to unstable political events which endangers carrying out the IMT programmes;
  - It is preferred that from the beginning of rehabilitation process to keep the WUAs' representatives informed and provide desirable condition for their cooperation with GRWC, and involved consulting Eng. and contractor;

- Simultaneity of IM improvement and physical rehabilitation, causes to facilitate and expedite the reform process and also it makes the involved agencies, (stake holders) effective participation; before the IMT, the government will secure the rehabilitation costs of the main canal, lateral and tertiary canals but in case of quaternary canals (head ditches). The WUAs are liable to improve and rehabilitate.

One of the main included objects in setting up the training workshops is to consider and decide about the necessity and importance of farmers' participation in rehabilitation of quaternary canals (head ditches), to be carried out along with other canals, the farmers in training workshops will compare different options for rehabilitation of quaternary canals, rehabilitation of existing system or modifying irrigation from gravity to pressurized system, and selection of more convenient option.

In the event that, the farmers need financial facilities for rehabilitation of the quaternary canals, they might receive the needed money partially or totally as banking loan, based on current criteria and regulations.

SUMMING UP AND CONCLUSIONS

1- Proposed remedies and solutions are based on conclusions from the studies and analysis and include the main measures have to be taken to meet the IMT requirements;

2- The origin of the difficulties lies in centralized planning and government's irrigation management shadowed the GIS for a period of 3 decades. In order to overcome those difficulties, informing and empowerment of the WUAs should be carried out from one side and from the other hand the background for reforming and capacity development of the related public sections' staff has to be provided in such a way that the expected reform and transformation based on the joint participation to be materialized.

3- Overall and perfect planning, efficient management, constant following up the related activities, constructive discipline and continuous care, are provisions for successful irrigation management improvement plans. Any thing has not to be thought evident and simple, the best way of good performance is thinking and the most perfect thinking is acting. The thinking which clarifies the action in turn gives information about the action, and the action which gives information to thinking, takes information from thinking.

4- Improving the objects and plans in the absence of a system of management and monitoring in the beginning stage and without establishment of an evaluation system, will confront with difficulties in the execution process. Timely recognizing the problems, removing the difficulties fastly, preventing any deviation of project's rehabilitation activities, are overally possible through continuous following up the works and moving along a precise direction.

5- The successful IMT requires overall national efforts along the participatory direction and the WUAs have to be supported and the local societies' skills and efforts must be sustained and carried on as well.

6- Planning and successful execution of the participatory programmes such as arrangement or participatory irrigation management (PIM) is much more difficult and complicated than carrying out the centralized plans.

   a. As a mater of fact, in relation with the farmers, they take long time to achieve participatory insight and nature, and concerning the government's staff, also they need long period to put aside their bureaucratic behavior and to make self compatible to participatory approach. Although the young tree of participation grows slowly and gets gradual stability but it stands sustainable and becomes fruitful.

7- Verifying the objects and plans, carrying out the activities and following up the work, all need cooperation of competent and experienced consulting engineers and experts in participatory methods.

8- The involved public organizations' determination and goodwill, their planning based on thoughtfulness and providing pre necessaries and convenient basis for performing the related process all together are the first priority requirements.

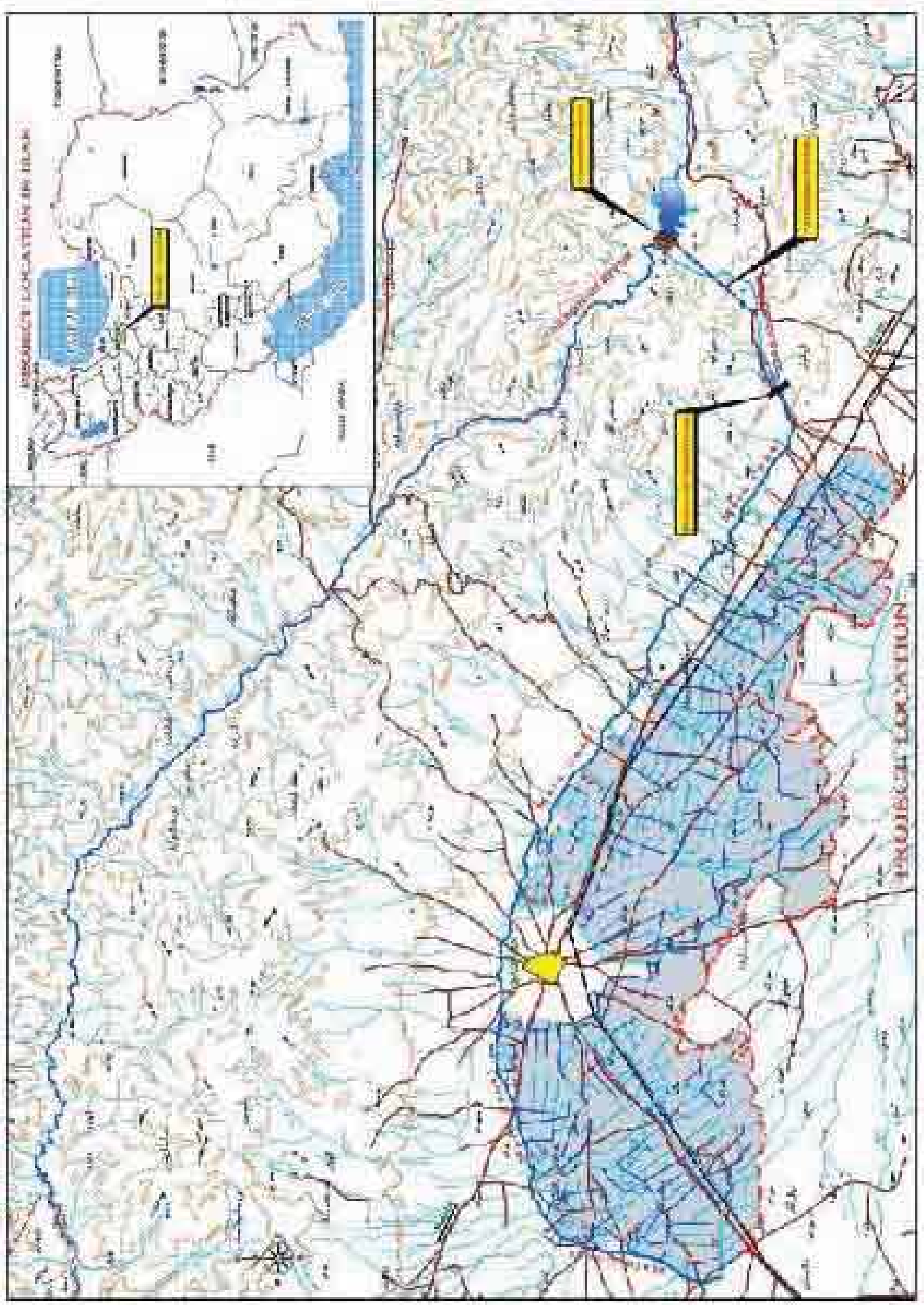


Figure 1: Map of Ghazvin Irrigation Network

ABBREVIATIONS:

GDP:	Ghazvin Development Project
GISOC:	Ghazvin Irrigation System Operation Company
GIS:	Ghazvin Irrigation System
GAIP:	Ghazvin Area Irrigation Project
GAIOC:	Ghazvin Area Irrigation Operation Company
GARO:	Ghazvin Area Reclamation Organization
GAIS:	Ghazvin Area Irrigation System
GRWC:	Ghazvin Regional Water Company
IMT:	Irrigation Management Transfer
IM:	Irrigation Management
MOJA:	Ministry of Jahad Agriculture
MO&M:	Management, Operation and Maintenance
MOE:	Ministry of Energy
O&M:	Operation and Maintenance
WUAs:	Water Users Associations
PA:	Participatory Approach
PRA:	Participatory Rural Appraisal

REFERENCES

1- Rehabilitation studies of Ghazvin irrigation and drainage system – conclusions – Pandam Consulting Engs. 2006 Tehran.

2- Regulations of irrigation and drainage system operation and maintenance companies – Management and Planning Organization of Iran – 2003 Tehran.

3- Guidelines for irrigation management services transfer – publication No. 55 – Iranian National Committee on Irrigation & Drainage (IRNCID) – 2002- Tehran.

4- Participatory Approach, (methods and techniques), Hableh Rud Project – Dr. Parviz Homayounpoor, 2000- Tehran.

LEGISLATION FOR SUSTAINABLE WATER USER ASSOCIATIONS

Stephen Hodgson[1]

ABSTRACT

This paper considers the legislation necessary for sustainable Water User Associations (WUAs). The findings are of general application but are particularly relevant to Iran in connection with the Government of Iran/World Bank funded Alborz Integrated Land and Water Management Project. A number of distinct legislative topics, which may in turn be addressed in a range of separate laws, should be considered. The author will introduce some key legal features that need to be addressed drawing on examples from Europe (East and West), Central Asia and North America.

First, there is the legislation that regulates the establishment and operation of WUAs. Experience shows the importance of having specific legislation in place that permits the establishment of WUAs as a specific type of legal entity. In other words while WUAs can typically be established (in the sense of being formally registered) using an existing organisational form, sooner or later one or more of a number of legal problems are likely to threaten their sustainability. Specific legislation can take account of the public interest nature of WUAs.

Next it is important to ensure that irrigation and drainage sector legislation, including land tenure legislation, is supportive. If it is not, then once again the sustainability of WUAs may be threatened. For example WUAs need secure long term rights to receive irrigation water from a bulk water supplier as well as the legal right to use publicly owned infrastructure. Tariff structures should support the establishment of WUAs while at the same time it is important that suitable mechanisms are in place to provide incentives to the bulk water supplier to provide an efficient and responsive service.

Finally, it is important to have effective basic water legislation in place in the form of a modern water code or water resources law. While this is clearly desirable from a water resources management perspective the absence of such a law, and in particular the lack of water security that may ensue, can also threaten the sustainability of WUAs.

1- Consultant in environmental law & policy, Avenue du Paddock 156, 1150 Brussels, Belgium, Tel/fax+ 32 (0) 2 772 9982, email: shodgson@gn.apc.org.

1- INTRODUCTION

This paper considers the legislation necessary for sustainable water user associations (WUAs). Its primary focus is the legislation (in the form of laws, acts of parliament etc) relating to the establishment and operation of WUAs. This is sometimes described as ‘enabling legislation’. Of almost equal importance, though, is the legislation that regulates the irrigation and drainage sector as well as basic water legislation in the form of a water code or a water resources law.

In contrast to the large body of literature on other aspects of participatory irrigation management (PIM) and WUA development relatively little has been published on the topic of WUA legislation. This, it is suggested, is a significant omission. After all, legislation ultimately underpins all aspects of WUA formation and activity, including institutional matters. It follows that the absence of appropriate legislation (because the there simply is no legislation or because the legislation that exists is ill-adapted to PIM) will negatively impact WUA sustainability, even if it permits WUAs to be formally established.

Based on the experiences of a number of transition countries in Eastern Europe and Central Asia[1] (the ‘transition countries’), but also on practice in Western Europe and North America, the findings of this paper are of general application. They are also considered to be particularly relevant to Iran in connection with the Government of Iran/World Bank funded Alborz Integrated Land and Water Management Project.

The paper is set out in five parts including this introduction. Part Two considers the legislation relating to WUAs and Part Three considers irrigation sector legislation. The important contribution to WUA sustainability of basic water legislation is briefly considered in Part Four while conclusions are drawn in Part Five.

2- LEGISLATION ON WUAS

The background to the establishment of WUAs in the transition countries was the dissolution of the large collective farms (known variously as state farms, collective farms, *agro-kombinats* and cooperatives) that were such a feature of socialist agriculture.

Although the precise arrangements varied from state to state, during the socialist period each farm was basically responsible for the operation and maintenance of its own ‘on-farm’ irrigation system. Apart from those cases where a collective farm had access to its own water source, irrigation water was supplied to each collective farm by a state irrigation ministry or agency (the ‘irrigation agency’).

1- Including Albania, Armenia, Azerbaijan, Bulgaria, the FYR Macedonia, Georgia, the Kyrgyz Republic and Romania.

Land and agrarian reforms, which began in the 1990s, saw the break up of the collective farms and either: (a) the distribution of the land they had used among their former workforce; or (b) the restitution of that land to former owners or their descendants.[1]

These reforms had significant impacts on the irrigation sector. First of all the dissolution of the collective farms meant that there was no longer anyone responsible for the operation and maintenance of the 'on-farm' irrigation systems. At the same time land reforms meant that the process of distributing irrigation water had become a great deal more complex. Within each (former) on-farm irrigation system, the large fields of the collective farms were typically split into scores, hundreds even, of small land plots each planted with different crops and thus with different water requirements.

In the absence of any other obviously viable solution[2] and with the support of a range of donors, including the World Bank, the transition countries moved to establish WUAs to take responsibility for the operation and maintenance of the on-farm irrigation systems.

From the outset it was clear that in order to be able to function effectively WUAs would need to have independent legal personality. In other words they would need to have the legal capacity enter into contracts, including contracts of employment, to hold property, to open bank accounts and to take and defend legal proceedings in their own name, independently of their participants. Without independent legal personality WUAs would not be able to: have a legal relationship with their members or with third parties; hold use or ownership rights over irrigation infrastructure and other assets or; hold water rights.

Although in a number of countries brief references were made to WUAs in new water or irrigation legislation[3] this typically did not elaborate in any detail what a WUA was or how it was to operate. Thus WUAs themselves were established on the basis of existing legislation using existing organisational forms such as companies (in Azerbaijan and Bulgaria), co-operatives (in Armenia, Bulgaria, Georgia) and various types of civil association or non-government organisation (in Albania, FYR Macedonia, the Kyrgyz Republic and Romania).

WUAs could be said to have been "successfully established" in the sense that following the relevant registration procedure they acquired independent legal personality, a governing document[4], a membership, a bank account and so forth.[5] However sooner or later, in a pattern repeated in country after country, one or more of a number of legal problems arose, problems that threatened the sustainability of the new WUAs.

1- Generally speaking distribution was undertaken in the states of the former Soviet Union while restitution took place in those states where collectivisation took place after the Second World War (including the Baltic States).

2- The irrigation agencies had insufficient resources to take over this task, local governments were rather weak and, given the depressed state of post-socialist agriculture, privatisation was not seen as a realistic or desirable option.

3- For example, article 24 (3) of the Azerbaijani Law on Amelioration of 1996 simply provided: 'To organise operation and protection of amelioration and irrigation systems being in joint or individual ownership, to manage them, to collect water fees, to settle disputes arising during the use of water and to solve other issues, an association of water users could be established. These associations' activities shall be regulated by the legislation of Azerbaijan Republic.'

4- Described variously as a 'statute', a 'charter' or a 'constitution'.

5- Although sometimes restrictions on possible membership restricted the success of WUA establishment a point that is returned to below.

2-1- LEGAL PROBLEMS ARISING FROM THE USE OF EXISTING ORGANIZATIONAL FORMS

In no particular order the legal problems typically encountered included the following:

First of all, as a result of the use of existing organizational forms the precise nature and purpose of WUAs was not always clear either to farmers or government officials. It is not surprising that before agreeing to work together farmers wanted to have a clear picture as to the purpose and scope of activities of WUAs. This is normal human behaviour – who would join a club before being aware of the implications of membership? Such caution was particularly strong in the transition countries where, following the experience of collectivization, farmers were often somewhat skeptical about the merits of collective activity. This had an impact on trust in the concept of WUA establishment and on the support farmers were willing to provide. For people who had been on PIM seminars and overseas field trips the concept was perhaps clear. The problem is that at a conceptual level none of these organisational forms is really suitable for WUAs.

Companies and cooperatives, for example, are business legal forms, used to make profits for their participants. How could this be reconciled with the idea that WUAs are supposed to operate on a non-profit basis? On the other hand, associations are used to establish private clubs such as football clubs. Were WUAs just private clubs? Furthermore while associations may typically undertake commercial activities <u>ancillary</u> to their main task, the buying and selling of irrigation water, which is a type of commercial activity, is actually the main task of a WUA.

Another common problem with the use of existing organisational forms concerned the issue or participation. In some countries the legislation precluded the participation of legal persons[1]; elsewhere it appeared to prevent the participation of natural persons[2]. As farms had typically been established as both natural and legal persons such restrictions were hardly conducive to broad participation. In some countries the legislation required a capital contribution from potential 'WUA' members that precluded all but the richest from membership or participation in the establishment procedure.3 In any event, such legislation could not, by its very nature, confer legal rights to membership of WUAs nor specify the rights and obligations of members with any degree of specificity certainly as far as rights to water were concerned.

Furthermore the legislation typically permitted the establishment by only a handful of people of a WUA that might potentially have hundreds of members. WUAs could, and indeed often were established largely on paper. In cases where this happened, those who had not participated in the establishment process (and who had sometimes not even been consulted) understandably felt little sense of ownership over 'their' WUA, in some cases (rightly) distrusting the motives of the WUA founders. In a number of cases WUAs were set up as companies or cooperatives by the entrepreneurial and well connected who saw an opportunity to set up a monopoly business.

1- Eg FYR Macedonia.
2- Eg the Kyrgyz Republic.
3- Eg Georgia.

Another problem was that governance structures designed for small private businesses and private associations were not always sufficiently robust or flexible for WUAs. For at the heart of each WUA lies a contradiction. They are premised on the basis that farmers will cooperate, while those same farmers are frequently in competition for scarce water resources. Clear mechanisms to promote accountability are thus particularly important. At the same time, such mechanisms must take account of variations in the sizes of the farms of those who participate in WUAs. The typical "one member, one vote" model is frequently unsuitable where, as was often the case in a number of the transition countries, there were large variations in the size of landholdings. On the other hand it is extremely difficult to ensure transparency if more complex approaches to vote allocation are used with legislative backing.

In some countries, such as the Kyrgyz Republic, as a result of the lack of suitable primary legislation extensive use was made of subordinate legislation in the form of regulations, decrees and so forth. This approach was not popular. Farmers, with some justification, argued that if governments were seeking to promote WUAs as a matter of policy then this should be backed up in legislation. Subordinate legislation, by its very nature, can be easily changed. Why should farmers invest time and effort in such flimsy structures?

Another frequent problem with the use of existing organisational forms was that changes made to the relevant legislation for other un-related reasons frequently negatively impacted WUAs. This happened in Romania where new non-government organisation legislation, intended to simplify legislation governing non-government organisations, significantly modified the internal structures of existing WUAs by removing various safeguards that had been carefully included to promote WUA transparency.

Flowing from the first point the lack of clarity as to the nature and purpose of WUAs frequently led to problems regarding their appropriate tax treatment. First of all, WUAs established as companies or cooperatives, which are legal forms that are intended to make profits, were frequently liable to profit taxes notwithstanding their proclaimed non-profit objectives. At the same time, as already noted, the use of the association form also created problems due to the fact that the commercial activity of water purchase and sale was in fact the principal task undertaken by WUAs. In any event even though WUAs do not seek to make and distribute a ‘profit’ they need to operate on commercial lines and to have a surplus of income over expenditure each year. In Romania, for example, the Tax Inspectorate argued that as WUAs were non-profit organizations, they could not hold over any surpluses from accounting year to year.

Furthermore as they had been established under private law there was frequently no formal means whereby the ministry or agency responsible for irrigation, could supervise the performance of WUAs or audit their accounts. Nor was there any legal means for such bodies to supervise their establishment procedure. The WUAs were private entities and thus free to get on with their business subject, typically, to relatively minimal supervision by the Ministry of Justice.

Finally there was the problem of compulsory measures. As noted above WUAs are premised on the basis that farmers will cooperate in their common self-interest. Training and capacity building can help this process as can the benefits of successful water distribution. But what if farmers don't cooperate or pay fees and charges owed to the WUA? In countries where irrigation is essential for agriculture it may be possible to cut off the supply of water but this option is not relevant as far as payments for the costs of field drainage are concerned and is not likely to be effective where irrigation is supplemental. Similarly what of the case where farmers refuse access to their land for the purpose of operation and maintenance or where they refuse to allow water to flow across their land? Expecting WUAs to launch court proceedings as private legal persons was clearly not a realistic solution.

These legal problems were evidently not the only problems faced by the new WUAs in the transition countries. Other problems included the challenges of agriculture in the transition economies including loss of markets, shortage of inputs and lack of farming experience, as well as degraded irrigation infrastructure. Nevertheless the legal problems were real, a threat to WUA sustainability and in need of a solution.

2-2- EXPERIENCE OF COUNTRIES WITH LONGSTANDING WUA LEGISLATION

As already mentioned the rich body of literature on PIM and WUAs, which has tended to focus on the experiences of so-called developing countries, has generally paid little attention to legislation and the legal aspects of WUA establishment. Instead it was necessary to turn to the experience, and the legislation, of the countries of Western Europe and North America which have their own long established WUA tradition. WUAs in Spain, the Netherlands and Germany, which undertake a range of water management tasks including irrigation and drainage, can trace their roots back over many hundreds of years.

Although the detail varies from country to country an examination of the relevant legislation revealed a number of important common features. First of all the legislation provides for WUAs to be established as a specific type of organisational form. In other words WUAs are established as WUAs and not as cooperatives, companies or associations.

Secondly, WUAs are invariably established on the basis of specific WUA legislation. Furthermore, although examples do exist of WUAs that are established on the basis of very old legislation,1 much of the legislation is surprisingly recent. WUAs in Spain, Germany and France are regulated by legislating dating from 1985, 1991 and 2004 respectively.

Thirdly, the legislation is relatively detailed addressing most aspects of the establishment and operation of a WUA. This is legally necessary (because of the fact that a WUA is a particular organisational form) but it also allows the specific requirements of WUAs to be addressed.

Finally, in contrast with the WUAs that had been established in the transition countries on the basis of private law organisational forms (companies, cooperatives and associations), WUAs in West Europe and North America are invariably established on the basis of public law as 'bodies of public law' or 'public (statutory) corporations'. Public law is the body of legal rules that regulates the conduct of state bodies (including

1- In Northern France and Belgium for example.

central and local government) as well as bodies that undertake public functions (such as state agencies and universities) on the basis of specific laws. Nevertheless WUAs in Western Europe and North America are still controlled by their members and managed in a participatory manner.

Public law status enables the public interest functions of WUAs to be taken into account. A moment's reflection shows why this is conceptually the correct legal basis for WUA establishment. Most of the problems faced by the early WUAs in the transition countries arose as a result of the inability of the existing private law legislation to reflect their public interest nature. For while WUAs are controlled by their participants, they provide a service that is in the public interest. They operate state-owned assets and use a state-owned resource (water) which is characterised as a 'public good' in this context. The correct operation of WUAs is a matter of public interest. They are not simply private clubs or companies. A farmer whose land lies within the service area of non-functioning or poorly functioning WUA cannot simply move to join another one, or for that matter, realistically establish a new WUA using the same infrastructure.

The legal effect of having public law status is that WUAs lie halfway between the state and the private sector. Thus they are self-managed setting of their own tariffs and making their own decisions as well as their operating rules. While they may be entitled to claim subsidies or state assistance, they are largely self-financing the bulk of their income being provided by their participants. They operate on a 'non-profit' basis or, more accurately, such profits (surpluses) as they accumulate are retained rather than distributed.

At the same time the performance of such WUAs is supervised by the state which may challenge their decisions in the courts. It is, however, important to note that the a decision taken by a WUA on the grounds of illegality. In other words the supervisory agency can only challenge a decision made by a WUA if that decision is legally incorrect: it cannot challenge a decision that it does not like in order to substitute its own decision. Despite their public law status WUAs retain their independence from state bodies involved in the irrigation sector.

Finally by reason of the legislation and their public law status, WUAs focus only on clearly defined water management tasks. They cannot branch out into potentially risky commercial activities. A person who joins a WUA knows full well that it will only undertake water related activities. Furthermore because a WUA has a single task it is easier to determine whether or not that task is being achieved.

The benefits of this approach, in other words establishing WUAs as WUAs on the basis of specific legislation as bodies of public law, are numerous. Furthermore this approach provides solutions to the kinds of legal problem outlined above.

First of all the fact that WUAs are established on the basis of specific legislation means that their purpose can be clearly specified from the outset as can the manner in which they are to be established and operated. A potential WUA member can understand exactly, for example, what WUA membership entails, how the WUA operates and what it can do. Similarly other actors can easily understand how WUAs fit into the overall scheme of water management, what their rights and duties are. It also means that the legislation can take account of the specific nature of WUAs through, for example, the provision of suitable and appropriate governance structures that are designed to promote transparency and effective rule making.

Establishing WUAs under public law makes it possible to confer favourable tax treatment upon them. They can, as non-profit bodies, be exempted from the duty to pay profit tax. In many countries they are also exempted from the requirement to levy value-added tax (VAT) or alternatively their services are 'zero rated' for VAT purposes.[1]

Public law status makes it easier to transfer user or even ownership rights over state owned infrastructure to WUAs. There is not question of privatization as WUAs are not private law entities. It also permits the legislation to confer powers on WUAs to take and impose compulsory measures. These can include: the right to impose compulsory membership/participation on those who benefit from the WUA's activity; the right to levy compulsory charges regarding, for example, the costs of maintaining an irrigation system; the right to make binding operational rules concerning, for example, the use and allocation of irrigation water; compulsory access rights over land the purpose of operation and maintenance and if necessary the rights to compulsorily acquire land; and the right to recover outstanding fees and charges on the basis of direct execution (for example by imposing a lien over the land of a debtor) without needing first to obtain a judgment in the civil courts. While such powers sound quite draconian in practice they are seldom used. It is sufficient that WUAs have such powers and that WUA members are aware of this.

Finally, the use of specific legislation means that provision can be made for WUAs to be effectively supervised by the state so as to ensure that they operate fairly and lawfully in the interests of their participants as well as in the wider public interest.

A full discussion of the contents of such WUA legislation, and new the WUA laws adopted in the transition countries is beyond the scope of this paper.[2] Evidently each country's legislation is different and adapted to its own cultural, legal and social norms. Simply copying the legislation from, say, a West European country would not be a realistic solution for any country.

Nevertheless clear similarities can be found including similarities of approach. A common but mistaken perception of legislation is to conceive of it only in terms of 'command and control' type laws, regulatory rules that set out what can and cannot be done and which establish penalties for non-compliance.

In contrast WUA laws should be seen as 'organisational' rather than prescriptive. Elinor Ostrom many years ago correctly warned against the use of 'blueprints' for the design of WUAs.[3] Just as each irrigation system is different so it is likely that each individual WUA will be different. The role of an effective WUA law is to set out the basic parameters within which the design of each individual WUA can be 'crafted'. At the same time such a law must set out minimum criteria necessary to ensure transparency

1- In other words VAT is payable at the rate of 0%.
2- See Food and Agriculture Organization of the United Nations (FAO), 2003. *Legislation on water user organizations*., by S. Hodgson, Legislative Study No.79, Rome, for a discussion of this topic. http://www.fao.org/Legal/legstud/list-e.htm
3- Ostrom, E. Crafting institutions for self-managing irrigation systems 1992, ICS, San Franscisco at page 11.

and robust governance structures while at the same time conferring substantive legal rights and duties on WUA members.

Finally there is one important issue that for reasons of legislative form and practice usually cannot be fully addressed in a WUA law and that is the issue of tax liability. At best a WUA law can create the appropriate legal conditions for WUAs to be exempted from tax liability but usually such an exemption can only be created through tax legislation.

3- IRRIGATION AND DRAINAGE LEGISLATION

Effective WUA legislation is not however sufficient to guarantee WUA sustainability. Experience in the transition countries shows that it is equally important to ensure that irrigation and drainage sector legislation, including land tenure legislation, is appropriate and supportive.

Improved security water of water delivery can be a key incentive for farmers to establish WUAs. Evidently in order to be able to provide such increased water security WUAs need this kind of security themselves either on the basis of long term legal rights to abstract water from a natural source or, more commonly, on the basis of a long term contractual right with a bulk water supplier (usually a state agency). Annual contracts with no legislative backing offer little in the way of water security. What if there is a dispute? How can a WUA be sure that the supplier will enter into a new contract the following year? Ideally such contractual arrangements should be backed up with legislation that should also specify that within their service area WUAs are to have an effective monopoly over irrigation water supply. Otherwise the situation can arise, as happened in FYR Macedonia, where at a local level the bulk water suppliers competed with WUAs for customers.

Next WUAs will very often need to have express legal rights to use publicly owned irrigation infrastructure. If WUAs do not have such rights or if they are weak or vague then very quickly problems regarding responsibility for maintenance can arise with no-one willing to undertake this.

Another argument in favour of PIM is that WUAs can usually provide a cheaper as well as a better service to farmers. Here the legislation relating to tariff structures may have a negative impact on WUA sustainability if, for example, there is a fixed national tariff for retail water delivery or if tariffs are subject to regulatory approval by a state anti-monopoly body.

Finally it is important to ensure that legal and institutional framework contains appropriate incentives for the bulk water supplier to provide an efficient and responsive service to WUAs. This issue raises a much broader set of questions of course that may go beyond a PIM programme but nevertheless may have a significant impact on WUA sustainability. In particular it is important to 'sell' the idea that strong WUAs can be valuable customers for such organisations but at the same time it is important that such organisations have an internal structure that is conducive to this end.

4- WATER RESOURCES LEGISLATION

Finally, the sustainable operation of WUAs relies on the effective management of water resources in general and the secure allocation of water to the irrigation sector in particular. To this end it is important to enact and implement basic water legislation, in the form of a modern water code or water resources law. The key issue here is water rights. A full discussion of the importance of water rights is beyond the scope of this paper[1] but, to give a concrete example, unless a bulk irrigation water supplier holds secure long term water rights it is difficult, impossible even, for that supplier to enter into a long term water supply contract with WUAs. Without such water security, as outlined above, the sustainability of WUAs can be threatened.

5- CONCLUSION

Legislation is clearly not a panacea. It cannot, by itself, guarantee the sustainability of WUAs. On the other hand, as outlined in this paper if appropriate legislation is not in place then even though WUAs can usually be established using existing laws they are not likely to be sustainable.

Particularly in the concept of individual investment projects there is an understandable tendency to ‘make do’ with the legislation that is currently available. Changing existing legislation, or adopting new legislation, can be a lengthy and challenging process, one that of necessity involves stakeholders outside the irrigation sector including other ministries, the government and ultimately parliament. But if such investments are to be fully realised, or if PIM is adopted as part of a national policy, then just as one would pay careful attention to the economic, financial, social and engineering aspects equally it is necessary to have regard to legislative issues and the experience and practices of other countries. The body of detailed legislation relating to WUAs found in Western Europe, North America and now in the transition countries is there for a good reason. After all no country adopts legislation for fun!

1- See Food and Agriculture Organization of the United Nations (FAO), 2006. *Modern water rights*., by S. Hodgson, Legislative Study No.92, Rome. http://www.fao.org/Legal/legstud/list-e.htm

MOSLEM LAW AND INTERSTATE WATER RESOURCES MANAGEMENT IN CENTRAL ASIA

Rysbekov Yusup[1]

ABSTRACT

Moslem Law (ML) started establishing on territory of Central Asia (CA) in the end of VII c. Proliferation of Islam in arid climate zones determined specific character of ML. The majority of ML norms are imperative and conditioned by its public nature as well as orientation at satisfying common interests. Analysis shows that many ML norms can be implemented in the water legislation, in particular:

- "If water distribution was made through sluices (gateways), but someone wants to distribute water by days, the previous order of distribution must remain in force";
- "If the owner of the river's top part can use water only through the sluice's closing, he can close a sluice only in time of his turn and at the consent of others…";
- If someone has the right for use of a certain amount of water in different time, then he cannot use all water at one time, as at consent of other co-owners"; etc.

But main, there is the norm, which should be "restored in its rights". This ML norm says: "If some of the owners cannot make use of the river other than putting a barrage across it and co-owners reach the agreement between themselves, then the turn to withdraw water for irrigation must start from downstream and proceed upstream…"

This provision may be accepted as the key principle of water management in CA and it would facilitate observance of water discipline by upstream water users.

1. CENTRAL ASIAN COUNTRIES' WATER LEGISLATION AND REGIONAL WATER POLITICS

1.1. NATIONAL WATER LEGISLATION

In the Soviet period water relations in republics of Central Asia (CA) and between them were regulated by "Bases of the Water legislation of the Union SSR…" [2] and national

1- Dr. Yusup Khaidarovich Rysbekov, Director Assistant Scientific-Information Center of Interstate Coordination Water Commission (SIC ICWC) of Central Asia 11, Karasu-4, Tashkent, 700187, Republic of Uzbekistan Tel. (998 712) 65 16 59; Fax (998 71) 166 50 97
E-mails: <yusuprysbekov@icwc-aral.uz>, <Yusuf.Bek.004@rambler.ru>

water legislation, which were issued according to the named “Bases…”. Independence’s declaration by the CA States (Republic of Kazakhstan, Kyrgyz Republic, Republic of Tajikistan, Turkmenistan and Republic of Uzbekistan) has caused necessity of processing of the water legislation at national and interstate levels.

During 1993-1994 the Water Code of Kazakhstan (31.03.1993), Law of Uzbekistan "About water and water use" (06.05.1993), Water Code of Tajikistan (27.12.1993), Law of Kyrgyzstan "About water" (14.01.1994) were accepted. Water Code of Turkmenistan (from 01.06.1973) remained working up to 2004. The named “sovereign” Water Laws of SA States were prepared on an old pattern, the attempts of entering of essentially new rules were reduced as a whole to reconfiguration, dissociation and overlapping of sections, chapters, clauses, parts, items of the old Water Laws.

The new wave in development of the water relations’ legislative base begins since 2000.

Now the working acts in sphere of the water relations are:

- The Water Code of Kazakhstan, is accepted 09.07.2003,
- The Water Code of Kyrgyzstan, 12.01.2005,
- The Water Code of Tajikistan, 29.11.2000,
- The Code of Turkmenistan "About water", 01.11.2004,
- The Law of Uzbekistan "About water and water use", 06.05.1993.

Now Water legislation of Kazakhstan and Kyrgyzstan is considered as most progressive in Central Asian region (CAR). At the same time, the Water legislation of all CA States allows to introduce the basic principles of the Integrated Water Resources Management (IWRM) to the national Water politics.

1.2. REGIONAL WATER POLITICS

The basic directions of regional water politics are determined by the decisions of the CA States’ Heads. The basic political-legal documents, in which the key principles of the regional water relations are determined, are following:

1. Interstate Agreement (ISA) between Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan "About cooperation in sphere of a joint management of use and protection of water resources of interstate sources" (1992).
2. Decisions of the CA States’ Heads (1993), according to which the International Fund for Saving the Aral Sea (IFAS) is created. For years of independence IFAS has accepted a number of important political decisions in sphere of the regional water resources use.
3. ISA between Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan "About joint actions on decision of the Aral sea’s problems…" (1993).
4. Concept of the CA States (1993) on problems of the Aral Sea Basin (ASB), which has incorporated rules, which are entered in the IWRM theory in modern understanding.

5. Decision of the CA States' Heads and Russia Government (1994), by which the First ASB-Program (ASBP-1) is confirmed.
6. Declaration and Statement of the CA States' Heads (Nukus, 1995; Issykkul, 1995; Almaty, 1997; Tashkent, 1998, 2001; Ashgabat, 1999; Dushanbe, 2002; etc.), according which the politics of sustainable water management is determined.
7. ISA between Turkmenistan and Uzbekistan "About cooperation on water-economy questions" (1996).
8. ISA between Kazakhstan, Kyrgyzstan and Uzbekistan "About Syrdarya river basins' water-power resources use" (1998); Tajikistan has joined the Agreement in 1999.
9. ASBP-2, prepared on behalf of the CA States' Heads and approved by them, is accepted in Dushanbe (2002). ASBP-2 is the key political document, which reflects the basic problems of the ASB in water and nature protection spheres.

From the listed above documents the Agreements 1992, 1993, 1996 and 1998 are the legal acts, according to which the transboundary WRM (TWRM) is carried out.

Among the named Agreements the Agreement 1993 is the more political document, which establishes the general approaches to the TWRM in CA.

Last years the certain efforts on development new water legislation are undertaken, however this work goes rather slowly. In particular, ASBP-2 has 14 Priorities, from which first is called "Development of the coordinated mechanisms of the complex water resources management in the Aral Sea Basin". More than 10 ISA-drafts should be prepared according to the Priority #1. Weak account of local traditions and experience in this sphere is one of omissions by preparation of the legal acts' drafts. At the same time, the water relations' history has deep roots and traditions in CA.

2. WATER RELATIONS' DEVELOPMENT IN CENTRAL ASIA

2.1. ROOTS OF THE WATER/LAND RELATIONS' LEGAL REGULATION

The cradle of state regulation of the ownership relations dates back to ancient times. These relations are connected with the first states' creation and have from 2 up to 5.5 millenniums history. Creation of first states in valleys of large rivers (the Tigris, Nile, Euphrates, Indus, Gang etc.) and getting surplus product at the account of irrigation entailed necessity of legal regulation of the land/water ownership relations. Land/water relations ranked as the special element of legal systems in states, development of which was based on the "Oriental way", at which: (a) Irrigated agriculture was a basis of economics; (b) Irrigation structures belonged to the state; (c) Agricultural community was up a primary cell of the society" [9, p.26]. "Oriental way" of the state's formation the experts characterize as "state–authority", and "European way" – as "state-property".

Presence of the "irrigation theory" among other theories (alongside with violence, class, theological etc.) specifies the water factor's importance at the first states' forming.

Questions of genesis of the various legal systems and place in them water and land relations on the CA territory have not only perceptual or theoretical interest, but have practical interest. They are important in a context of application study bearing in mind adaptability of their provisions and principles for elaborating national and international water legislation in water-ecological sphere.

2.2. PRE-ISLAMIC PERIOD

Legal relations at the earliest stage of states emergence had been forming within the framework of religious-philosophical doctrines, of which Zoroastrianism, Judaism, Christianity, Buddhism, Manichaeism became the most famous in CA (Maverannakhr). Early Zoroastrianism (VIII-V cc. B.C.) made clear difference between good divinities (headed by Ahur Mazda), and sinister demons occurring as inevitable "by-product of creation" (headed by the spirit of evil Ahriman). From the point of view of the Ecological law the Zoroastrianism postulate is of interest, according to which evil forces transform "the fertile lands into desert", make "water saline and unfit for drinking", etc., and as to the outcome of the struggle between forces of good and evil it depends on "personal choice" made by living creatures, first of all - by human[1].

In later periods (V-IV c. B.C.) of development, excluding period of Greek-Macedonian conquests, Zoroastrianism underwent a series of transformations, but remained prevailing religious-legal ideology in Maverannakhr.

During Hellenes domination (end of IV – beginning of the second half of II c B.C.) a dualistic variant of Zoroastrian Law appeared. Presumably in this very hard period the legal norms of Zoroastrianism were formulated in 5 writings, of which Videvdat[2] ("Law against evil forces") remained safe. For the objectives of the present work a part of Videvdat is of interest, which describes crimes against Nature forces – land, water, fire and vegetation. In Videvdat "special attention was given to water, counter pollution activities were carried out... For non-observance of this requirement a penalty was imposed in the form of "400 lashes…" [7, p.68].

In particular, following dialogue between Zoroaster and Ahur Mazda deserves attention.

- "Who is the fourth one giving most pleasure to the Land"?
- "Who plants more cereals, rich fodder and eatable fruit! There where he irrigates soil because it is dry or carries out land drainage because it is too wet".

This Ahur Mazda's answer reflects the gist of irrigated land reclamation.

In Zoroastrianism the contract's respect and principles of its performance were considered very important. From 6 types of contracts the supreme force was given that, which was bound on "fertile land". This contract could cancel obligations of other types of contracts (bound by the word, handshake, in pawn of a sheep, ox, and man).

1- In Zoroastrianism all alive essences admitted by the Law's subjects.

2- Videvdat is a part of the literary monument of Zoroastrian – "Avesta", which is translated by specialists as "law", "legislation" and consists of Large Avesta and Small Avesta. Large Avesta includes as one of three major parts the Videvdat, which is considered as the juridical compendium of Zoroastrianism. Videvdat consists 22 chapters represented in form of dialogs between Zoroaster and Ahur Mazda.

The Law's performance and necessity of the correct choice are key requirements of Zoroastrianism. Contract's respect was also one of conditions for supreme authority; a good ruler was considered the one who laws' performance and kept to the contract's terms ("he is firm in belief, and faithful in the contract"). Many experts recognize that Zoroastrian Law "not less than in Roman Law the principles of "individual rights" had been formed and implemented, and that Zoroastrian Laws underline "peoples' free will" [9, p.177]. Thus, in Maverannakhr the framework of legal system had been formed at the leading role of Zoroastrianism and substantial influence on it other religious-legal and philosophical doctrines. Social-legal norms, worked out during the pre-Islamic period, had influenced on norms of Moslem Law.

2.3. ISLAMIC PERIOD

Moslem (Koranic) Law started establishing itself in Maverannakhr, which became a part of the Arab Caliphate, in the end of VII – beginning of VIII cc. Until X c. Moslem Law (ML) had been developing on the basis of interpretations of the Koran and Sunnas made by Islamic theologians. In opinion of the experts, in X c. (after titanic work had been done as to codification of Moslem Law by leading lawyers of that time) development of the traditional ML is stopped, and precise meaning of rules and principles of ML are formulated in VII-X cc.

Considerable contribution into the ML development was made in IX-XII cc. by the Maverannakhr philosophers: Faraby, Gazaly, Al Bukhary, At Termezy, Marginany and others. And in the posterior period the influence of Maverannakhr intelligentsia on ML took place. With the beginning of Russian domination in Turkestan (as a whole, the Maverannakhr territory, second half of XIX c.) the ML-development stopped.

2.4. SOVIET PERIOD

With an establishment of the Soviet authority (1920-ties), in exact opinion of the experts, "europeaization of law, truncated in the soviet form" took place.

Some ML-norms retained valid in first years of the Soviet authority in Turkestan.

Basically it concerned present Khorezm and Bukhara provinces, where the Soviet authority was established much later and with the large efforts. For instance, the Constitution of the Khorezm National Soviet Republic (from 1920) recognized a private property on ground and water. Up to Independence the Legal system of each Soviet republic was developed within the framework of the Soviet legal system, which was formed on the West-European models (basically on English-Roman-German samples).

3. MOSLEM LAW AND REGIONAL WATER RELATIONS

3.1. GENERAL PROVISIONS

Undoubtedly, Moslem Law (ML) is an independent legal system, playing the central role in legal systems of many states. It was tolerant to other non-Islamic legal norms (personal rights of non-Moslems, norms of European Law etc.). Specialists acknowledge that ML was more then millennium ahead of European legislators in interpreting criminal responsibility and civil law.

Islam's proliferation in the arid climate zones determined the specificity of ML. As the artificial irrigation could be effectively managed only by efforts of community, institutes of private and communal ownership of land and water emerged. The Fikh[1] acknowledges three major categories of land ownership - state, vakoof and private [8]. The Fikh included in the concept "property" also various other rights (for example, on water's part of the river). The important meaning has the provision of ML - "pastures, sources of water, fire and salt belong to everybody" (The Koran). In ML the important place is borrowed by rules about the contracts and obligations, and an accent is done on prime performance of the obligations in comparison with the rights of Moslems. The obligations follow from the contract, which is valid at presence of three conditions ("arkans" –"pillars"): a) contracting parties, b) their voluntary consent, and c) suitable subject of the contract. ML recognizes as the illegal contracts, which contain immoral conditions. In ML the contracts pursuing economic benefit, should proceed from the concept legal ("halal"). The contracts are illegal, if they are connected with "riba" or providing an opportunity of "riba" (extraction, to gamble, unreliability, risk etc).

In ML the actions of the social-legal relations' subjects on 5 categories (obligatory, recommended, permitted, blamed and forbidden) were divided that it is useful to know by development of the normative acts. Major part of the ML-norms are imperative and conditioned by its public nature as well as orientation at satisfying common interests, this leading to prioritizing obligations as compared to rights of Moslem [10, p.82].

In addition to such generally accepted legal norms as "Jus cogens", "Pacta sunt servanda", ML perceived other well-known legal institutes (servitudes etc.), as well as the rather flexible principle "Rebus distantibus" ("as the circumstances dictate").

So, the latter principle is fixed in ML as "a norm in the process of its existence and disappearance is guided by the destiny of its foundation", and others [11, p.35].

Comparison a principles of the religious-legal systems in CA from times immemorial until today and major principles of International Law shows that a similarity is presented between them (equality of the parties, peaceful dispute settlement, reparation of damages etc.). It is natural, because International Law has been developing guided by "positive legal capital" accumulated by various legal systems. At the same time, such provisions of Zoroastrianism as necessity of "the correct choice", severe norms about water pollution, of ML - about "the legal economic benefit", interdiction contracts, which contains immoral conditions and connected with risk, of tolerance to the lawmaking activity by the other party, etc. require the positive judgment.

3.2. REGIONAL WATER RELATIONS: A PLACE OF THE MOSLEM LAW

Generally principles of International Water Law (IWL) are based on special principles of International Environmental Law (IEL) and fundamental principles of International Law (IL), and they may be summarized in the synthesized form as follows [5, 6, 12-14]:

1- Fikh – the legal doctrine (Science about Law) of Islam. Fikh is more "practical" Science of Law as compared to Shariah, which includes a wide spectrum of religious, legal and social norms.

(a) Equity of rights of riparian States for equitable and reasonable use of TWR;

(b) Not causing of damage to transboudary watercourse and environment;

(c) Compensation for inflicted damage;

(d) Cooperation in TWR-use while observing common interests of all and specific interests ones of each of riparian States.

As qualitatively new should be acknowledged the principle that has been recently put forward concerning necessity of recognizing "the right of Nature to water", which answers requirements of ecosystem approach to the environmental management[1].

What should be rejected and what should be reviewed creatively while considering of the Moslem Water Law (MWL)? Apparently, those provisions of MWL, which do not contradict to generally acknowledged principles of IL, IEL and IWL might be worthy of consideration. At the same time, such terms as "a large river", "a common river", "a private river", "water of large rivers", "private use" and some others should be assumed by creative approach (e.g. abstracting). Last hundred years the picture of international water relations has sharply changed. It is enough to say that such MWL-rule as "the rivers, which belong to nobody and waters' use from which is not subject to distribution (for example, Euphrates)" is hopelessly obsolete.

It seems, the following MWL-norms, are comfortable to the water situation in CA [4]:

- "In case of disagreement concerning water's volume, which can use by co-owners of the river, water's volume is determined proportionally to size of their irrigated lands";
- "If water distribution was made through sluices (gateways), but someone wants to distribute water by days, the previous order of distribution must remain in force";
- "If the owner of the river's top part can use water only through the sluice's closing, he has the right to close a sluice only in time of his turn and at the consent of others…";
- "If water distribution is carried out through gateways, then it is forbidden to do both to enlarge and to move them the upstream";
- "If each of the co-owners of the river has the right to use the certain number of sluices, nobody of them may add a single sluice";
- If someone has the right for use of a certain amount of water in different time, then he cannot use all water at one time, as at consent of other co-owners"; etc.

But such MWL-norm, as "If the water's owner wants to prevent someone from water use, and the latter is in need of water and afraid for himself or for his cattle, then he has the right to fight against the water's owner with weapon…" [4], deserves consigning to oblivion and should be sent to historical archives, the same might be said about directly ("literal") understanding and incorrect interpretation some provisions of the Koran.

As an example of such interpretation of the divine message it is possible to result the following. In late 1860-ties in the course of the first water release through the new

1- So, CA-States' Heads agreed that the Aral Sea is a separate "Water User" equal to every republic.

Ulugnar canal (Ferghana valley, Turkestan) water has broken one of the canal boards. “Obscurants from among local clergy, witnessing the disaster, carried out a religious ritual “fetva” (prediction of the God) and suggested khan officials to block water break by bodies of farmers known by names “Tokhta” and “Tokhtasyn”[1]. …About one hundred men bearing these names became victims of the unlawful action. Tied into bundles the people were thrown down the water rush alongside with brushwood in the capacity of live fascines forming the fascine dam, stones and reeds were thrown at them until the rush was at last liquidated” [3, p.38].

But there is the norm, which should be “restored in its rights”:

“If some of owners cannot use by river other than putting a barrage across it, and co-owners reach the agreement between themselves, then a turn to withdraw water for irrigation must start from downstream and proceed upstream; when the turn will reach upstream of the river, the permission is given to block the river” [4].

It seems that this norm contains deep philosophical meaning, which (bearing in mind the Aral Sea and countries of its basin) may be referred to as “the unity of national and universal human values”, and this concept might promote implementing into practice of WRM in CAR and answers to the paradigm "everyone live in river’s downstream”. This would to a great extent facilitate observance of water discipline by upstream water users. The above-named norm has not emerged from nowhere; overuse of water by upstream water users is actually beyond enforced control, as opposed to downstream practices (to turn off water is quite enough for controlling the set limits).

INSTEAD OF THE CONCLUSION

Sustainable development of the CA States is impossible without solving the problems of regional TWRM, which boil down, if expressed in one phrase, to “mismatch of interests between upper and lower reaches of the rivers”, and the TWRM-principles, reflected in agreements of the CA States’ Heads, may be formulated as “long-term mutually beneficial strategy of equitable and reasonable use of TWR”.

Water controversies occurring from time to time between countries of the region should be composed, in particular, as it is recommended by the Koran: “And if two troops of believers would fight with each other, reconcile them. If one is unjust to another, then fight against the one who is unjust, until the latter apply to God’s will. And if he applies, then reconcile them for justice and be unprejudiced: after all God loves those who are unprejudiced” [1, p.296], implying by fighting discussions on water law issues, and by “God’s will” – major principles of civilized relations between states based on IL.

Nobody will give ready recipes for the decision of CA water problems because... these recipes do not exist. It seems that the development of the legal bases of TWRM in Central Asia taking into account the experience of our ancestors in this sphere is one of ways of prevention of the interstate water conflicts in the future.

1- "Tokhta", "Tokhtasyn" = "Stop", "Let him stop".

REFERENCES

1. The Koran (translation by I. U. Krachkovsky) – Moscow: "Madjess", 1990.
2. “Bases of Water legislation of the Union SSR and union republics". Constitution and Laws of the Union SSR. – Moscow: “The USSR National Deputies' Council News”, 1982: 401-415
3. Baturin S.I. Soviet irrigation of Uzbekistan. Tashkent: Gosizdat UzSSR. 1954.
4. Consolidated enactments of Moslem Law (Shariah) on water/land use. – Tashkent: SIC ICWC of Central Asia, 2001: 34p.
5. Fazelyanov E. Water as the factor of peace and stability: problems of Nile in a mirror of international law. // “Asia and Africa today”, 1999, #11: 2-8
6. Lazerwitz D.J. Development of International Water Law: The International Law Commission’s Law on the non-navigational uses of international watercourses. //. Collected works # 2 (9): “International and national water law and policy” – Tashkent: SIC ICWC, 2001: 67-84
7. Lebedeva S., Karahodjaeva O. “Avesta” – the most ancient book. // “Davlat va Hukuk” (“State and Law”), 2001, № 1-2
8. Rakhmanov A. Moslem Law: vakoof property. – Tashkent: GNI “UME”, 2001
9. Rtveladze E.V., Saidov A.H., Abdullaev E.V. Studies on history of ancient Uzbekistan civilization: Statehood and Law. – Tashkent: “Adolat”, 2000
10. Syukiyainen L.R. Moslem Law. – Moscow: “Vostochnaya literatura”, 1986
11. Syukiyainen L.R. Structure of Moslem Law. – Moscow: Institute of Sate and Law of the USSR Academy of Sciences, 1984
12. Umarakhunov I.M. Republic of Uzbekistan and International Law of Agreements. –Tashkent: "UME", 1998
13. Rysbekov Yu.Kh. Transboundary water resources of Central Asia: political and legal bases of their use without conflicts. // Proceedings of the Central-Asian International Scientific-practical Conference “ICWC towards to 4 World Water Forum: local actions for prevention of water crisis”. Alma-Ata/Tashkent, 2005: 124-132
14. Wouters P. Role of water law in the development of integrated water resources management strategy.// Collected works №2 (9): "International and national water law and policy" – Tashkent: SIC ICWC of Central Asia, 2001: 4-10

GOVERNMENTAL CO-OPERATION AND SUPPORTS NEEDED TO STRENGTHEN THE WATER USERS COOPERATIVES.
(CASE STUDY: NORTHEASTERN I.R.IRAN)

Mohamad Gholami Beyraghdar[1]

INTRODUCTION

Before the land reformation in Iran, the farmers could manage their own traditional system of dam construction and block water, agricultural water use, and network maintenance and fair water distribution. Due to water shortage during draught years, farmers used to learn how to optimize the usage of agricultural water. The farmers had their own traditional cooperatives such as “Boneh”, “Sahra” etc (Safinejad, 1353). Good cooperation existed between farmers and the key persons of the rural societies .The government had no interference with the farmer's cooperatives. The interference of government started when land reformation began, before the Islamic Revolution.

The cooperatives formed before the Islamic revolution, were supposed to be a political program for land reformation. Farmers believed that the government forms the cooperatives for its own benefit. Water users associations formed in 1990-2000, were also unsuccessful because social and cultural issues as well as tribal and religious conditions were not considered in details or government support was not enough to strengthen the cooperatives. Among Water users cooperatives with a successful history we can refer to Pishro cooperative in Moghan irrigation network and Water users Union in Serakhs city.

A research done by Pourzand (Pourzand,Esfand 1383) Shows that Pishro WUC in Moghan received enough cooperation and good support from local government sectors. The close cooperation and co-ordination among local authorities in Moghan and their financial and technical support to Water Users Cooperative resulted in formation of a successful cooperative. Unfortunately this cooperative deteriorated due to conflict between cooperative managers and the members. It is supposed that the lack of pre-survey on social and cultural situation of the region might be a reason for deterioration . In a recent experiment in Serakhs (Amayesh consulting Co. – 1385), new established cooperatives could clean the water canals by free technical support received from local government sectors. These canals needed clearance since many years ago however, neither government nor individual land owners could manage to clear the canals. When Serakhs WUCs formed in 1385(2006), the cooperatives union could receive technical support and mechanical machinery from the local government and clean the irrigation

1- Member of scientific board, Amayesh Consulting Co., Mashad, IRAN
Fax: 985117621658; Tel: 98511 7640040-4; e.mail: info@amayeshco.com or mohamad_gb@yahoo.com

canals so that they could increase water for agricultural irrigation. Both in Moghan and Serakhs experiments, the local managers of agriculture and water departments in the region, had the same belief and sympathy as the provincial authorities toward the new established cooperatives. The above examples show that with a good cooperation and close coordination of governmental sectors, the cooperatives will be strong and sustainable in the future.

OBJECTIVE

The purpose of this paper is to describe the procedure of establishing the Water Users Cooperatives in north-eastern part of IRAN and explain the governmental support needed to keep these new born cooperatives of water users sustainable for the future.

THEORETICAL DISCUSSION

In natural disasters such as floods, earthquake, draught and also in an international problem such as global warming, the cooperation among nations or among societies of a country is the means of mitigation and reduction of suffer in any disaster. A good experiment in Iran was the Bam earthquake where at the moment of accident the people were present before the arrival of the governmental aid groups in the ruined region.

During recent years, the shortage of water is threatening Iran country. The shortage of water in Mashad and also the shortage of agricultural water in rural areas is a great problem. Government alone cannot afford the combat against draught. The constructed dams cannot provide enough water to compensate the shortage of irrigation water. It seems that without cooperation of farmers the problem could not be solved. To provide more water for irrigation we need people participation in optimization of water usage as well as a fair water distribution.

International experiments on the optimization of water usage shows that the people participation in irrigation management is a good solution (INCID-1998). The legal framework has been prepared for Participatory Irrigation Management in Iran and many rules have been adopted to support water users associations (the office of economic water, 1383 – Ministry of cooperation , 1376). According to IR of Iran Constitution, the cooperative system is one of the main bodies of our economic infrastructures. According to different approved texts in Iran, the previous four years development plans, people participation in economic development has been emphasized. According to the article No 107 of the 3rd Four-year Social and Economic Development plan of IRAN that re-approved in article 17 of the fourth development plan, the participation of people in irrigation management and the establishment of water users associations is a necessity for Iran development .

Following the rules and regulations, a water consultant in Mashad has started formation of Water Users Cooperatives (WUCs) with financial support of regional water companies and, here in this paper, the experiences of WUCs formation is represented.

METHOD:

A. Book review, Internet search and field study:

Persian and English sources and the experiments of other cases on PIM were studied. Famous web sites were visited including those related to irrigation management and cooperatives. Many country reports on participatory irrigation management (PIM) were reviewed through Internet.

B. Execution of the project:

Execution started with visiting the farms, the dams and the irrigation and drainage systems. Other implementation procedures were as follows:

Individuals and groups were met and the need and the benefit of water users associations were discussed with farmers. Many public meetings with farmers and water users were arranged in the mosques or schools of the villages and the project was explained to farmers in detail. The advantages of associations and information of rules and procedures to organize a legal association of water users was described to them. Four full-day seminars with the subject of water use optimization organized in the public meetings which approximately 250 farmers and key persons of the villages and the city authorities participated in each seminar. Invited professors of the universities and the authorities of the agriculture and water management presented lectures on the transfer of water management to farmers in easy language in all these informative seminars. In another meeting with participation of all water users the consultant lecturers explained the different kind of rural associations and asked the farmers to choose their favorite association. The water users preferred the cooperative system because they believed that more facilities are provided to farmers in the cooperation system. They brought reasons of the Constitution and the articles in 3rd and 4the economical and social development plan, which mentioned support to rural cooperatives (Mohajerani and Asgari – 1384). They also mentioned the importance of cooperatives due to existence of a Ministry for it.

A guideline was prepared to be followed by the water users for legal registration of the WUCs.

In 2005-2006, 17 Water Users Cooperatives (WUCs) established in the down stream of the new constructed dams in the North and Razavi Provinces of Khorassan and approximately 13 other cooperatives are on process to be established. The duties approved for WUCs are as described below:

> (A) Collection of irrigation fees and return it to the regional water companies. (B) Participation in operation and maintenance of the network (C) Participation in distribution of water among water users based on the document of water right. (D) The members of WUCs will make their maximum efforts to optimize the use of agricultural water in irrigation. (E) WUCs will provide technical training to members for the maximum yield production with minimum use of water per hectare. (F) The cooperative managers will do their best effort to commercialize the cooperative activity by developing small and productive rural industry projects to bring benefit and welfare to water users.

The following table shows the specification of established WUCs at the down stream of constructed dams in the North-Khorassan and Razavi provinces in the northeastern part of Iran.

Table (1) New established WUCs in down stream of Shirindareh dam, 2006 (Bojnord)

Items	Cooperative	Registration No.	Members	Water allocated (million cu.m)	No. Villages
1	Mohamadabad	2058	576	8.8	One
2	Sephid-dasht	2063	317	4.7	Three
3	Imamazadeh Ashraf	2057	186	3.7	Three
4	khoramdasht	2071	229	4.6	One
5	Chuplytapeh-takhtemish	2061	143	3.6	Two
6	Imamzadeh Ghasem	2060	229	5.6	Two
7	Shirindasht Khorasan Shomali.	2081	159	4.5	Three
8	Kashkabad-Burbur	2080	152	1.47	Two
Total			1991	36.97	17

Table (2) New established WUCs in Serakhs, Farooj -Shirvan , and Esferayen 1385

Items	Cooperative name	Registrion No.	No. of members	Dam or Irrigation Basin	No of villages	Water Allocation (Million Cu. M)
1	Etehad	342	309	Doosti	4	4.7
2	Etefagh	343	879	Doosti	5	15.5
3	Yavaran		1164	Doosti	7	18.0
4	Sangar	341	186	Doosti	3	2.22
5	Nowruz	344	395	Doosti	5	5.9
6	Vahdat	348	331	Doosti	5	3.9
7	Nazarghah	477	400	Bidwas (Esferayen)	9	10.0
8	Ab-baran		100	Bidwas	5	6.0
9	Hosseinabad (Under ground W.Users)	641	143	Farooj Irrigation Basin	1	
10	Behyoos (On Process)		Approx.200	Farooj I.B.	1	
11	Mafranghah (on process)		Approx.100	Farooj I.B.	3	
Total			4207		48	

THE MAIN QUESTION

Through a hard and continuing efforts the consultant could organize approximately 17 water users cooperatives and 13 others on process, but the main question was not answered. Can these newborn cooperatives remain alive and continue their duties without governmental support? Our experience shows that different institutional support from governmental and private sectors should be provided to WUCs (at least for 4 years). Of course the independency of the cooperatives should not be overlooked by the direct governmental subsidies.

Some governmental supports could be provided to WUCs:

(1) Provincial support needed on matters beyond the capacity of WUCs. (2) Guidance and training as legal and office works, cooperative laws and regulations, public relations, accounting, computer and etc. (3) Technical support including: maintenance and repairing the canals, clearance of the canals and streams, technical inspections, technical advice on irrigation matters, technical and financial support on extreme natural disasters such as flood, when the land or irrigation canals are damaged or any repairing beyond the cooperative capacity. (4) Insurance programs to protect WUCs against unpredicted damages to network or their usual practices. (5)Extra funds could be allocated for continuation of guidance after the registration of WUCs. (6)Adequate guidelines and printed sources should be provided by consulting Co. for cooperatives in such a way that cooperative managers refer to manuals and technical references instead of asking questions. (7) Public seminars and informative sessions should be continued by consulting Co. (8) Fund and assistance of international related bodies who support cooperatives should be obtained for improvement activities of WUCs. (9) To provide incentives to sustain cooperatives, procedures should be developed to create income for WUCs. (10) In some cases, personnel of governmental water companies are not willing to transfer their authority of management to farmers, it is necessary that higher authorities discuss the matter to their personnel and convince them that government policy has been changed and they should give responsibility to cooperatives. (11) A formal formation of cooperatives will result in early disappearing of cooperatives. Government and his high authorities should pay serious attention to WUCs and pay great respect to authorized water users cooperatives. (12) Monitoring and evaluation of WUCs should be continued by consulting Co. and water companies. (13) Any advantages or interests should be given to WUCs in fair terms. (14) National authorities co-ordination should be continued by the Ministry of Power and Ministry of Jihad Agriculture. (15) WUCs should be strengthened by reengineering the networks and also providing them with incentive and support to repair the network when it is necessary. (16) To participate WUCs in basin management and dam construction. (17) Social recognition of WUCs by introducing them officially to governmental sectors involving in farmer cooperative business. (18) Legal recognition of WUCs by national, provincial and local government and private authorities. (19) Strong support is needed from judicial authorities. (20) Improvement of co-ordination among different governmental sectors involved in agriculture or water management is necessary. (21)Financial support for specialized training of consultant personnel through internal or international resources is necessary. (22) Women communities formation and giving responsibility of irrigation management to them is a necessity. Women can help and cooperate with men

in WUCs to optimize the irrigation water usage. (23) A collection of laws, regulations and any kind of Legal statements with the subject of assistance and support to WUCs should be prepared in easy language in one volume and be offered to WUCs free of charge. The texts should be updated and given legal references to each item before editing and being published.

CONCLUSION

The new established Water Users cooperatives cannot survive and be sustainable unless the support of the governmental sectors is provided, without interfering their independency. There are different methods to support the new WUCs. The laws and regulations let the authorities and governmental related sectors support the newborn water users cooperatives. The author believes that without government and private sector assistance, the new established WUCs cannot survive for a long time.

SUMMARY

Study the rich history of IRAN traditional irrigation system including Qantas, surface or spring water, will reveal the fact that traditional water management was one of best and strongest irrigation system for agricultural water users. The traditional water managers had their own definite and stable regulations and the landlords and peasants both followed the rules. The farmers used to distribute and use the water in a specialized cooperative methods that guaranteed the just and optimized water usage. During a short period of approximately 40 to 60 years, the governmental organizations took the performance of water distribution and networks maintenance, but the performance was not successful. During the period of governmental water management, the real water users were indifferent towards the proper use of water and the network maintenance. The government mismanagement resulted in deterioration of irrigation system and agricultural products. Fortunately according to the third and the fourth Iran Economic Development Plan, the strategies have been changed. The new rules and regulations such as Article 107 of the third Iran Development Plan (IDP) that re-approved in Article 17 of the fourth Development Plan, the strategy for rural development is “participation of farmers in irrigation management”. The transfer of water management from government to farmers is one of the government policy on irrigation, water usage and network maintenance. To implement the government policy on irrigation , the regional water companies of the North and Razavi Khorassan Provinces in the north-eastern part of Iran developed projects for establishment of cooperatives of agricultural water users in the down stream of three new constructed dams called: Doosti, Shirindareh and Bidwas, all located in the north-eastern part of IRAN. The farmers preferred Cooperative systems as an association of water users after several meetings and discussion among potential villages leaders and members of the Islamic council of the villages. Since 2005, 17 water users cooperatives (WUCs) have been established and 13 more cooperatives are in the process of formation are on process in the region.

The question remains after the cooperative establishment, is the fact that these new born cooperatives will not be able to continue their activities without further financial, legal and governmental supports. The author believes that without further support of governmental departments such as: insurance Co. , Legal institutions, justice courts, rural police, Jihad Agricultural Ministry and Cooperative Ministry, the life of these new established water users cooperatives can not survive.

RESOURCES:

1. Amayesh Consulting Co., 1385, Final Report on the Formation of Water Users Cooperatives in the down stream of Doosti Dam (Serakhs), Mashad.
2. Bryan Bruns and Helmi, 1996, Participatory Irrigation Management in Indonisia: Lesson from Experiences and issues for the Future, National workshop on participatory Irrigation Management, Indonisia
3. COPAC Open Forum, 26-27 October 1999, Successful cooperative models in East & Central Europe, Berlin
4. Farshi, Ali Asghar, 1383, Optimization of water usage, IRNCID Web, Tehran.
5. Gobal Naik, Amar H.Karlo, 1998, Two case studies on the role of Water Users ‘ associations in Irrigation Management in Maharashtra, India
6. Groenfeldt D. and P.Sun, 1997, Demand Management of Irrigation systems through Users Participation, Participatory Management Workshop, 9-15, 1077, Colombia.
7. Iran National Committee of Irrigation and Drainage (INCID), 1998, World Experiments of Participatory Irrigation Management, Tehran.
8. Larouche G, and J. F. Metzger, 2002, Making Irrigation Management works in a participatory way: The case study of North Suiawesi of Indonisia, FAO-ICID Workshop, 24 July 2002, CANADA
9. Ministry of Cooperation (Training Office), 1383, Familirization of Managers with law and regulations of Cooperation, Tehran. 192p
10. Ministry of cooperation, 1376, assemblage of Cooperatives law and regulations (in three Vol.), Tehran. 1850 p
11. Mohajerani and Asgari-1384, Past Cooperation Changes, no 61- Iran villages and development series publication, Tehran. 300p
12. Pourzand A., 24 July 2002, Past and present situation of water users organizations, A case study in Ghazvin Irrigation network. FAO-ICID workshop, Canada
13. Pourzand, Ahmad, Esfand1383, practical guidelines for establishment of Water Users Associations and their participation in management of irrigation and drainage network, Water Management Company , Ministry of Power,Tehran.
14. The Office of Economic water, (Deputy for Programming), 1383, assemblage of laws and regulations for water fees, Tehran
15. Safinejad, Javad, 1353, Boneh, Tehran
16. www.undp.org, United Nations Development Programs.

17. www.Taavonkhr.ir (Ministry of Co-operation)
18. www.copac.org, How to start a cooperative, cooperatives information report.
19. www.inpim.org, International Network on Participatory Irrigation management.
20. www.irncid.org, Articles , The first seminar on survey of problems in irrigation and drainage and optimization of water usage (in Persian).
21. www.icid.org, publication, ICID survey on Funding of Operation , Maintenance and management of Irrigation projects.
22. www.CARD.iastate.edu, Brent Hueth,Philippe and Roger Ginder,2004 , Cooperative Formation and financial contracting in agricultural Markets, working paper 03-WP349

THE MECHANISM ON THE EFFECTIVE MANAGEMENT OF MULTI-OBJECTIVE WATER RESOURCES

Chang-Chi Cheng[1], Ming-Young Jan[2], and Yuan-Chuan Lee[3]

ABSTRACT

Due to the fast growing demand of water resources, the effectiveness on the management mechanism of multi-objective water resources has become the focus of future water resources management with limited water resources. Hence, the objective of this article is aimed to suggest a management mechanism through the evaluation of regional supply-demand relationships, application of appropriate models, reviewing current water transfer strategies among sectors, and the estimation of probabilistic flow-rates as well as the investigation of prices. This management mechanism should also include the platform for negotiation and a feasible promotion plan.

The preparation of the water transfer strategies has been proceeded by following the topics of (1) the appropriateness of past transfer cases of agricultural irrigation water, (2) the timing of possible transfer (or borrowing) of agricultural water, (3) the aid of irrigation water to other water sectors, (4) the compensation principles, and (5) the estimation of compensation.

From the experiences of water-right management as well as water-market management, while considering the local conditions, a quasi-official water-market arbitration and supervision organization is suggested in this article. This task-force of “Water-Market Management Committee” can be set up by following current regulations without creating new laws or administrations, and is operated by committee members. This Committee performs regular water monitoring during normal conditions, and is initiated when water-shortage or disputes occur.

I. FOREWORD

Due to the fast growing demand of water resources, the mechanism on the effective management of multi-objective water resources with limited water resources has become the focus of future water resources management. The long-term objective of

1- Associate Professor, Department of Industrial Engineering and Management, Ching-Yun University, #229 Chien-Hsing Road, Chung-Li, Tao-Yuan, Taiwan, tel: 886-3-4581196ext.6100, fax: 886-3-4683298, e-mail: faber@cyu.edu.tw
2- Associate Professor, Department of Civil Engineering, I-Shou University, Kaoshiung, Taiwan
3- Professor, Department of Environmental Resources, Leader University, Tainan, Taiwan

this article is to suggest a management mechanism through the evaluation of regional supply-demand relationships, application of appropriate models, reviewing current water transfer strategies among sectors, and the estimation of probabilistic flow-rates as well as the investigation of prices. This management mechanism should also include the platform for negotiation and a feasible promotion plan.

II. WATER RESOURCES IN TAIWAN

The average annual rainfall in Taiwan is 2,515 mm, and the total volume reaches 90.5 billion tons, which is approximately 2.7 times of the world average. Although the amount of rainfall sounds plenty, the water resources management is tough as the annual allocated water per capita is only around 1/8 of the world average due to the uneven distribution both temporally as well as spatially, as seen in Figure 1.

On demand side, the statistics show that the domestic water has increased from 730 million tons in 1976 to 3.53 billion tons in 2004, and industrial water from 1.35 to 1.65 billion tons, while agricultural water has decreased from 15.96 to 12.60 billion tons, and has been remaining almost stable since 1996. According to WRA, the water-resources authority, the projection of long-term demand with medium growth rate on a fire-year interval targeted in year 2021, shows same trend as shown in figure 2.

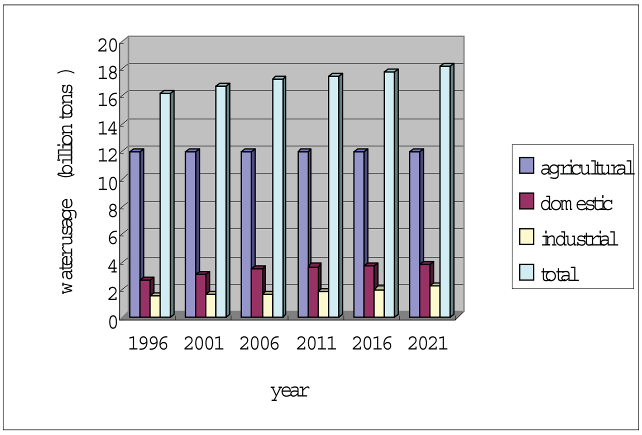


Figure 1 Annual Isohyetal Map of Taiwan

Figure 2 Trends of Water Demand for Various Sectors in Taiwan

III. PREPARATION OF WATER TRANSFER STRATEGIES

Most often cases of water transfer in Taiwan are from agricultural sector to domestic.

However, industrial sector has been facing frequent water shortage problems as well, and similarly, transfer or borrowing from agricultural has become sole and important solution before specific water sources intake systems are completed. As a result, it is necessary to setup a water transfer strategy among sectors in order to reach a win-win state.

1. Discussion on the appropriateness of past transfer cases

After reviewing past cases regarding transfer of agricultural water, following facts can be summarized:

1) Despite the fact that agricultural sector also faces water shortage, it is considered to be transferred whenever needed.

2) There is yet no reasonable compensation for the transfer of limited agricultural water resources.

3) The “value” of agricultural water resources is yet to be established.

4) Agricultural water right is seemingly abolished when frequent transfers are requested.

2. Types of transfer (or borrowing) of agricultural water

1) Permanent transfer,

2) Partial transfer, and

3) Temporary transfer.

3. Basic principles on the aid of agricultural water to other sectors

Based on past experiences of water transfer, following rules as well as basic principles are concluded:

1) During severe drought, the water resources is first re-allocated according to adjusted distribution. The first ranked domestic sector is eligible to transfer water from other lower ranked sectors when the necessary amount of water to sustain life and living needs is not acquired, and agricultural sector is always the one. However, proper compensation is needed as agriculture itself is also damaged from drought.

2) As the second ranked sector, the agricultural water is eligible to request transfer from lower ranked sectors. Although it rarely occurs, it is possible under food shortage conditions. In very few cases, it did happen when agricultural water requested aid form local deep wells of other sectors. However, the aid did not quite follow the priority order, and the compensations were based on negotiations.

3) Industrial water ranks third behind domestic and agricultural. Nonetheless, in order to protect industrial development, which has higher production value and is more vulnerable to water shortage, the transfer from agricultural sector often occurs. And most of the cases were proceeded through negotiations with agricultural sector, yet the reasonable compensation for the damage loss of farmers is yet to be determined.

IV. ESTABLISHMENT OF WATER QUANTITY MODELS

1. Assessment of suitable models

A number of mathematical or empirical models have been applied in various case studies of water-resources management in Taiwan, such as the Deterministic Optimal Operation Model, the Real-Time Optimization of Reservoir Operation Model, the Dynamic Reservoir Planning Model, the Delft Analysis Model, the Stochastic Dynamic Planning Model, the Stochastic Operation Model for Multi-objective Reservoir Operation Model, Fuzzy Stochastic Dynamic Planning Model, and Grey-Fuzzy Dynamic Planning Model, etc. However, it is difficult to determine a general model which can be applied in various cases. It is clear that the need for local water distribution occurs basically only when there is inconsistency between supply and demand. As a result, the difference between supply and demand becomes critical in the determination of proper measure as well as corresponding model to be adopted.

2. Measures corresponding to supply-demand analysis

In this article, it is suggested that the appropriate water quantity model can be established by proposing suitable measures with various corresponding supply-demand conditions, as shown in Figure 3.

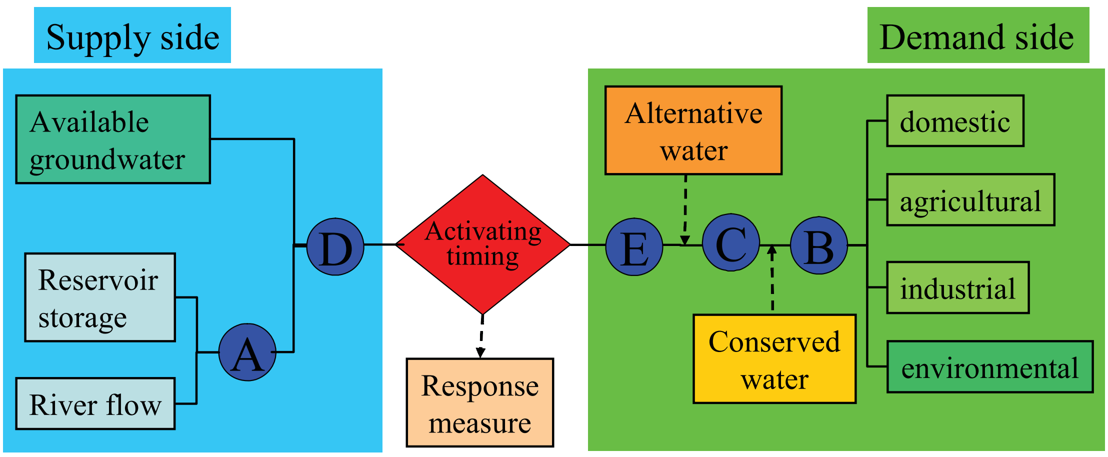


Figure 3 Supply-Demand analysis for water resources management

In Figure 3, the supply and demand sides are placed on both sides. On the left supply side, there are three water sources, namely available groundwater, reservoir storage, and river flow. On the right demand side, there are four water use sectors, namely, domestic, agricultural, industrial, and the important environmental. The starting timings to take corresponding measures are according to the difference between supply and demand conditions, and are classified into stages as follows.

Stage 1: When A>B, i.e., reservoir storage and river flow are able to satisfy demand needs, then strict groundwater conservation measure is enforced.

Stage 2: When A<B, the water-saving measure is first activted. Each water-use sector has its own duty to reduce its own demand in order to keep A>C.

Stage 3: When A<C, groundwater is introduced for conjunctive use in order to sustain D>C.

Stage 4: When D<C, measures for different water sectors are activated. For agricultural sector, fallow or crop change are conducted, while for domestic and industrial sector, alternative water sources, such as desalination water, recycled water, or reclaimed water, are introduced, in order to keep D>E.

Stage 5: When D<E, i.e., any or some of the water sectors are not capable of satisfying it or themselves, then transfer among sectors are required.

V. ESTABLISHMENT OF ECONOMIC MODELS

In this article, the assessment of economic models has focused on the compensation principles and the estimation of compensation. The CVM (Contingent Valuation Method) of on-site questionnaire has been adopted on the determination of compensation prices for the transfer of agricultural water to other sectors, and Chia-Nan area has been selected as the simulation area for validation. The rice farmers with the pressure of water being transferred were sampled according to 5 thousandth ratio.

The results show that the valuation of agricultural water, as converted to the willing-to-accept (WTA) price as the function of released water quantity per unit area land, is requested according to growing stages and different crops for 2.37 NT$/ton for the first crop made fallow before plantation while 1.56 NT$/ton for the second crop, 4.58 NT$/ton for the first crop during land-preparation while 3.82 NT$/ton for the second crop, and 8.06 NT$/ton for the first crop during blooming stage while 4.43 NT$/ton for the second crop.

As for the conception of farmers concerning the sources of budget, regardless of the sectors that agricultural water is been transferred to, the idea of “pay by the users” is accepted by the farmers, meanwhile, the government as well as the authority administration should be involved in the support of budget.

VI. MANAGEMENT ORGANIZATION OF MULTI-OBJECTIVE WATER SECTORS

The feasibility analysis of water-market management or water-transaction, which is recommended in this article, has been proceeded following the items of (1) the ideas and experiences of foreign countries, such as the United States, Australia, Germany, Mainland China, and Japan, as well as the system and operation principles of initiation point, such as Holland, and France, (2) current regulations and mechanism by the Water Resources Agency during droughts, (3) the concept of the water-transaction systems, and(4) the preparation of the initiation mechanism of water-market or water-transaction.

From the experiences of water-right management as well as water-market management, while considering the local conditions, a quasi-official water-market arbitration and supervision organization is suggested in this article. This task-force of "Water-Market Management Committee" can be set up by following current regulations without creating new laws or administrations, and is operated by committee members.

The committee members should be included from representative units, such as the water-right management authority, agricultural administration agencies, domestic water units, water-supply units, farmers representatives, related beneficiaries, and law as well as financial experts, etc., and may be further grouped into four units, namely authority agencies (e.g., Water Resources Agency, Council of Agriculture), water-right holders (e.g., Irrigation Associations, Reservoir Management Bureaus), water-use beneficiaries (Water Companies, Industrial Sectors), and professional staff (e.g., financial, accounting, legal, fair trade, or environmental) as shown in Figure 4.

The major objective of the Committee is to reach management, arbitration, negotiation, and supervision purposes on water transaction. The formation of the Committee is suggested to be promoted by government authorities, in order to creatively participate in the effective water distribution and rational price negotiations of water markets at the right time.

Regarding the mechanism of the operation of the organization, this Committee performs regular water monitoring during normal conditions by collecting and integrating water information, including data from supply side, demand side, as well as future forecasts, and is activated by a warning system when water-shortage or disputes occur, and the mediation of water quantity as well as pricing is started, as briefly shown in Figure 4.

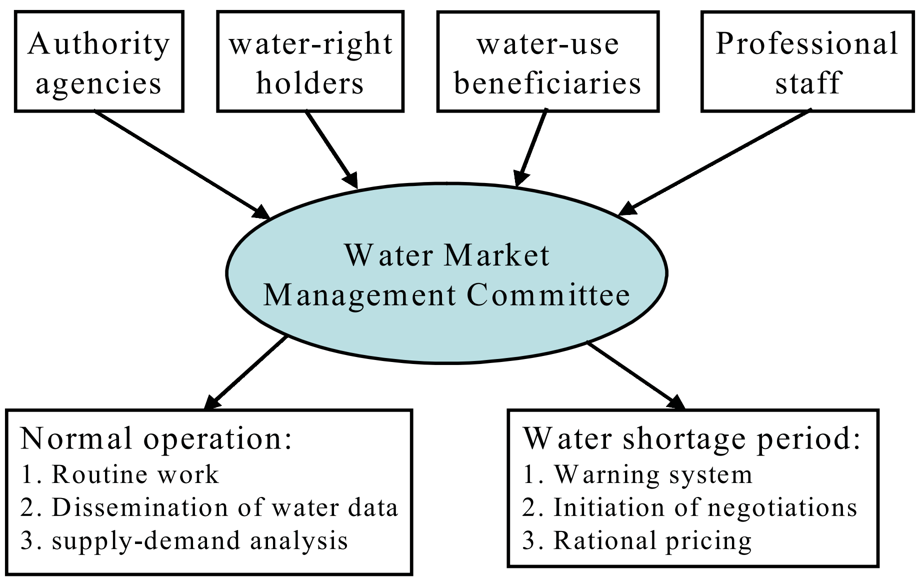


Figure 4 Conceptual platform of suggested management organization

More specifically, the challenging tasks of this Committee are the determination of rational prices on the transferred water, the effective allocation as well as distribution of the water resources, to resolve water-use disputes and panic during water shortage, and to mediate doubts on the uncertainty of water-right for the agricultural sector, as well as water supply for the industrial sector.

The timing on the activation of the Committee, in other words, can be set by the time when a party filed the request. According to past experiences in most water-use dispute cases, the requests are normally filed by following parties: (1) water resources authority agencies, (2) agricultural administrations, (3) central government, which calls assembly meeting based on water information analysis, and (4) industrial sector.

A flow chart on the activation mechanism for the negotiation of the Committee as well as the water market is suggested in Figure 5.

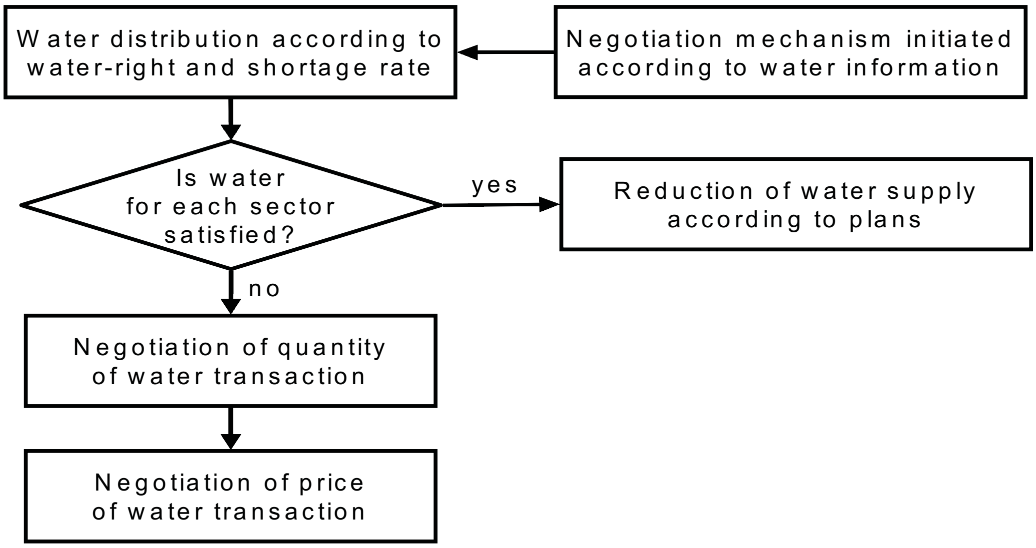


Figure 5 Suggested flow chart on the activation mechanism for the negotiation of water market

VII. CONCLUSIOONS AND SUGGESTIONS

1. Conclusions

1) On the effective use of water resources, a number of local applications of major models are briefly introduced, and the conceptual qualitative principles on the regional water distribution are suggested. As for further quantification of water distribution, the corresponding regulations and measures should be followed based on current water supply-and-demand conditions, and there should be an organization to take care of.
2) The preparation of the water-transfer strategies are performed by following the discussion on the subjects of: 1) the appropriateness of past transfer cases of agricultural irrigation water, (2) the timing of possible transfer (or borrowing) of

agricultural water, (3) the aid of irrigation water to other water sectors, (4) the compensation principles, and (5) the estimation of compensation. The application of these strategies is based on the fairness and justice of water transaction as well as transfer mechanism, and is significant on the promotion of the system as well as the establishment of water resources database.

3) From the experiences of water-right management as well as water-market management, while considering the local conditions, a quasi-official water-market arbitration and supervision organization is suggested in this article. This task-force of "Water-Market Management Committee" can be set up by following current regulations without creating new laws or administrations, and is operated by committee members. This Committee performs regular water monitoring during normal conditions, and is activated when water-shortage or disputes occur. The objective of effective water distribution as well as rational pricing is thus reached by the reasonable management on the supply and demand of water resources.

2. Suggestions

1) In order for further promotion, an "Organization regulations of the Water Market Management Committee" in correspondence with the "Water Market Management Committee" should be prepared. And in order to fully abide by current institutional systems, corresponding laws and regulations regarding water resources management during droughts or water shortage should be further compiled. It is also suggested that the test arbitration and negotiation should be carried out first in between quasi juridical persons (such as Irrigation Associations and Science Parks), and is gradually extended to other types of water transaction or transfer as experiences are accumulated.

PIM IN THE ABSHAR IRRIGATION SYSTEM, IRAN

Jaime D. Hoogesteger van Dijk and Linden Vincent[1]

ABSTRACT

Despite worldwide attention for "farmer participation" in irrigation systems, the diverse irrigation management partnerships in place and discussed as participatory approaches, and their prospects for transformation, are less frequently discussed. Most emphasis is given to water user organizations and their potential performance, while new institutions at higher scales, and processes of change in these institutions, are less frequently discussed. This paper[2] describes the institutional transformations in farmer and agency action in the the Zayandeh Rud river basin and the Abshar Irrigation System, at the basin, system and outlet level, based on field work executed in autumn 2004. It analyzes the context and social rules of participatory irrigation management of the Abshar Irrigation System and describes how participation is crafted at field level. This article analyses these practices and sets some question marks on whether and how PIM should be up-scaled within this specific context.

THE ZAYANDEH RUD BASIN

The Zayandeh Rud basin is situated in the centre of Iran and covers an area of 41,500 km^2. The basin originates in the Zagros Mountains at altitudes of around 2300 m, where rainfall and snow are abundant[3], and closes in the Gavkhuni swamp at an altitude of 1466 m (Murray-Rust *et al.,* 2000). The majority of the basin lies under an arid and semi-arid climate. The city of Esfahan, with almost two million inhabitants, and its fertile plains[4], form the main socio-economic area of the basin (Molle *et al.,* 2004).

For centuries, water from the Zayandeh Rud River has been diverted to supply the city of Esfahan with water and to irrigate its gardens and neighboring areas. The peak flows

---

1- Jaime D. Hoogesteger van Dijk (MSc) is presently Junior Researcher and Lecturer at the Irrigation and Water Engineering Group at Wageningen University in the Netherlands. E-mail: Jaime.hoogesteger@wur.nl Professor Linden Vincent is presently professor of the Irrigation and Water Engineering Group at Wageningen University in the Netherlands. E-mail: Linden.vincent@wur.nl Address: Irrigation and Water Engineering, P.O. Box 47, 6700 AA Wageningen T: +31 317 48 41 90 F: +31 317 48 47 59

2- This paper is based on the MSc thesis and field work (2004) of Jaime Hoogesteger that was supervised by Linden Vincent of Wageningen University and Francois Molle from the International Water Management Institute.

3- In the head of the basin at high altitudes precipitation averages at around 1700 mm a year.

4- The fertile plains are constituted by alluvial deposits flanking the Zayandeh Rud where slopes are gentle and soils have good soil moisture holding capacities (Salemi et al., 2000).

from April to June have provided the basis for widespread downstream irrigation, earlier developed using simple diversion structures called *mahdis*, to make productive use of floodwaters (Salemi *et al.,* 2000). Although irrigation has been practiced since 1500 AD, today most irrigation is characterized by institutionally-managed, large-scale canals with automatic upstream control through NEYRPIC systems and volumetric water delivery through the use of 'modules à masque'. Most traditional canals have been absorbed into the large-scale systems, while many qanats[1] have either fallen into disrepair or have dried up because of adjacent drilling of deep boreholes. In 1970 the Chadegan reservoir, with a 1,500 million cubic meter (MCM) capacity, was completed and started to function in 1971. This dam allowed the regulation of the water flows in the Zayandeh Rud River, which, coupled with the construction of modern[2] irrigation networks, allowed for the expansion of the already existing irrigated area to its present 270,000 ha (Morid, 2004).

WATER MANAGEMENT IN THE ZAYANDEH RUD BASIN

In the Zayandeh Rud Basin regulation of water resource exploitation and distribution is the responsibility of Esfahan Water Authority (EWA) that is supervised by the Ministry of Energy. This institute is responsible for surface and groundwater management in the basin. Within the irrigation sector the responsibility of the EWA extends to the outlet level. Water distribution in tertiary and lower level channel networks is coordinated by the Esfahan Agriculture Authority under the supervision of the Ministry of Jihad and Agriculture (Morid, 2004).

Before 1993 all the operation and maintenance (O&M) down to the outlet level was done directly by the staff of one of the departments of the EWA. Based on this department the EWA created a new decentralized semi-governmental organization that manages and operates all irrigation systems in the basin. This new institution is the Mirhab, which was created and contracted for the O&M of the irrigation networks in the basin in 1993.

1- Qanats consist of horizontal wells dug to reach groundwater at the base of hills, and consist of a "mother well" that reaches a water table followed by a gallery with a gentle slope that transports the water to the surface of the ground. Every 25-50 m shafts are provided for the removal of spoil and ventilation of the gallery. In Iran qanats have been used for centuries to provide water for cities and irrigations (Molle et al., 2004).

2- Halsema (2002, p.21) notes that since the 1960s, the general objectives of irrigation modernisation have been to realise a water delivery service that provides the opportunity and means to meet varying crop- and irrigation water requirements that stimulates efficiency in water use and increased productivity. In infrastructure terms, this has involved technological designs that can respond to crop choices and needs and thus deal with both variable and flexible water supply: the management structure developed also looks for such flexibility often through a central agency controlling flows upstream in combination with locally based institutions. One such approach is that described here in the AIS, with lined canals, upstream control through NEYRPIC systems and water delivery with 'modules à masque' and controlled by a central water management authority. Plusquellec *et al,.* (1994) emphasised that 'modern' schemes had: several levels with clearly defined interfaces, each able to provide reliable, timely and equitable water delivery; enforceable systems of mutual obligations; are responsive to users' needs, and are thus robust but also have communication systems to provide necessary information and control; have motivated and trained operators; and recognise the requirements of agriculture and existing social conditions.

Under the reform banner and as a result of the international and national debates on irrigation reform, the Mirhab has started a pilot project in which farmer participation is to be formally instituted in organizations for the management of the secondary canals of the modernized irrigation systems. But what are the existing forms of farmer participation in these irrigation systems and how might these shape the prospects of new institutions?

PARTICIPATION BELOW THE FORMAL INSTITUTIONS

Farmer participation takes place in a domain where the Mirhab and EWA are absent. In the current organizational vacuum that exists at the outlet level, local farmer participation dictates water control. At this level, it encompasses regulation and control of water flows and human behavior, in which processes of resource mobilization, decision making and conflict management are important and existing institutions make very effective.

The manner of participation in the water control arena is structured by traditions and socially embedded cultural values of water distribution. These are mechanisms that get shaped by the principles established in the socially embedded traditions that stem from the Toomar edict and the long history of irrigation in the area. These are generally referred to as 'the Sheikh Bahai rules' which set out a couple of rules for a fair distribution of water below the outlet.

RULES FOR WATER DISTRIBUTION

According to "the Sheikh Bahai" rules, an outlet is divided in six equal parts which are named *joughs*. Every *jough* has its own canal system, gates and sluices and is generally delimited by one 'main' canal within the outlet. These *joughs* rotate the full discharge of the water running though the canals by periods of one day. Every *jough* has one full day (24 hrs) of water at its disposition. The rotation works in such a way that the *jough* that in the first rotation gets the water first, gets, in the second rotation, the water the last - as seen in Figure 1. Such a system is also still in operation in the management of qanat rights (Molle *et al.,* 2004). At *jough* level the same rotation system works among the different users.

The water users that operate within the domain of an outlet are responsible for the operation and maintenance (O&M) of their distribution canals. The O&M of canals is organized by the users who usually establish one day on which all the users have to help with cleaning and repairing the canals. The *jough* and outlet tenders are responsible for the organization of these days. Depending on the outlet the maintenance works are done either once, twice and in some cases three times a year. Usually the work is done just before the summer season starts and at the beginning of the winter-spring season.

Every *jough* has a responsible ditch tender that has the responsibility of controlling water distribution and fee collection within the *jough*. These *jough* tenders in turn have to pay to the outlet tender - who is responsible for distributing water to the different *joughs*, collecting the fees from the *joughs* and paying the water fees for the whole outlet to the EWA. *Jough* and outlet tenders pay the water fees for their management area in advance and collect the water fees from individual farmers at the end of the growing season. The position of 'tender' for either an outlet or a *jough* is a position which is appointed through elections among the users. It is an honorary position (unpaid) and is usually granted to individuals that are respected in the community.

Despite the fact that there exist different kinds of water rights, every season these are renegotiated amongst users. The renegotiations of water rights are determined by factors such as the individual land area, crops produced, the history of the water use of individual farmers and the kind of water rights. In general, in these (re) negotiations of water rights within the outlet, small holdings get priority over larger holdings and people having rights that stem from traditional water rights have preference over more recent water rights that were created with the expansion of the irrigation network.

CONFLICT RESOLUTION

All management and conflict resolution within the outlet is the responsibility of the users. Conflict resolution is done mostly in the field among users. If two users cannot resolve the conflict, more users are called upon and the decision is set under discussion in the group and eventually to voting. If this mechanism does not offer a solution, the community elder is consulted. In case a conflict cannot be solved in this manner, it is taken to court.

Oorthuizen (2003) shows how relations of friendship, kinship and personal contacts are of utmost importance in determining the degree and manner of participation in water control and conflict resolution within irrigation systems. In AIS it is also mostly family, friends, and community bonds that grease the negotiations within the outlets. All farmers know each other and through different relationships they manage to make agreements on how to share and distribute water. A very important element in all these negotiations is the Sheikh Bahai rules that set the framework for negotiation and conflict resolution. Although these rules are not formalized on paper, they are fully embedded in the culture and traditions of the users, guiding their values and personal frameworks of negotiation.

During the field work it was very common to find several farmers in the field sitting under a tree or at a water division point negotiating and talking about matters of water management, the market price of different products or the difficulties they had, but also family and community issues. These are also forms of participation, although not taking place in formally structured organizations. They are examples of the diversity of forms of participation that Sengupta (1997) calls attention to, as important for irrigation. These encounters account for most of the participation in water control on the side of the farmers through the negotiation and interaction with the other actors involved in water control. This participation brings with it several benefits for the individual users and it is common that one farmer takes care of the irrigation of his neighbor's plots, that farmers share labor, hire machinery together and help each other in the maintenance and recreation of the agricultural production system.

AN EXAMPLE OF PARTICIPATIVE CONFLICT RESOLUTION

During one field visit to the outlet, the water flow being followed ended up at a field that had just been cut off from its irrigation water. A couple of meters further a group of farmers was involved in a serious discussion. What had happened was that farmer A had cut off the water of farmer B in order to irrigate his own field. According to farmer A the turn of farmer B had elapsed within the rotation scheme. Farmer B claimed that he was entitled to a longer turn. As farmer A and B could not agree other farmers had been called to mediate in the conflict. After a short discussion and explanation of the facts with the aid of the farmer that had his turn before farmer B, the group concluded that farmer A was in his right to direct the water to his field. Upon this decision, farmer B retired shouting and cursing and the group dissolved. Nevertheless, a week later farmer A and farmer B had jointly hired a rice combine to harvest rice on some other fields. This example shows how farmers are active participants in the crafting of irrigation management and the whole agricultural production process although there are no formalized structures for participatory irrigation management.

CONSEQUENCES FOR THE INSTITUTIONALIZATION OF PIM

Although farmers are not organized in a formal institution they all participate in the social structures that give form to the practices of water control. Their actions and forms of participation are shaped by day to day negotiations and cultural rules of water management that emerged long before the state intervened in irrigation management.

The recent effort to develop farmer organizations to enhance a certain form of institutionalized participation may threaten these cultural participation practices if these follow frequently used blueprints of organization – of how officials and international donor and funding agencies think participation should be structured. Often within these new structures pre-existing forms of organization and water control are ignored (Sengupta, 1997; Coward, 1985, Ostrom 1992). This can lead to far reaching changes in the existing social structures and a disruption of the established rules that guide established participation practices.

Understanding at what level and how participation shapes water control is essential to understand why and how farmers shape their water management practices and production systems. When considering the institutionalization of new structures to "enhance" participation, firstly, present management and decision making practices should be understood and considered. Secondly it should be evaluated if, within the existing context, it would make sense to institutionalize participation. Thirdly, if participation gets institutionalized it should be based on a thorough analysis of the already existing structures. Institutionalizing participation only makes sense where there is a felt need to change the existing institutional and social water control practices and structures which result in specific outcomes in the water management arena. Therefore the question that new initiatives for participation should address is: Within the existing context, what are the objectives that want to be achieved with institutionalizing farmer participation (at different decision making levels) and how can these objectives be achieved by working with the existing social structures?

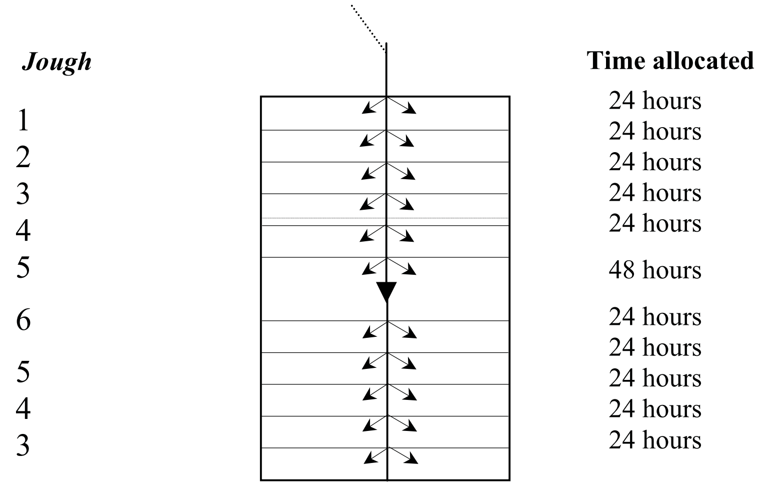


Figure 1 Water distribution system among *joughs*

REFERENCE:

1. Coward E.W., 1985. Technical and social change in currently irrigated regions: Rules, roles and rehabilitation. In *Putting people first: Sociological Variables in Rural Development,* ed. Cernea, M., Oxford University Press.
2. Halsema, G. van, 2002. *Trial and retrial: the evolution of irrigation modernization in NWFP, Pakistan.* PhD thesis, Wageningen University, The Netherlands.
3. Hoogesteger van Dijk, J.D. 2005. *"Making do with what we have" Understanding drought management strategies and their effect in the Zayandeh Rud Basin, Iran.* MSc Thesis. Wageningen University, Wageningen, The Netherlands.
4. Molle F., Mamanpoush A., Miranzadeh M., 2004. Robbing Yadullah's water to irrigate Saeid's garden: Hydrology and water rights in a village of Central Iran. IWMI Research Report No. 80..
5. Morid S., 2004. *Adaptation to climate change to enhance food security and environmental quality; Zayandeh Rub Basin, Iran.* College of Agriculture, Tarbiat Modarres University, Teheran, Iran.
6. Murray-Rust H., Sally H., Salemi H.R., Mamanpoush A., 2000. *An overview of the hydrology of the Zayandeh Rud Basin.* IAERI-IWMI, Iran.
7. Oorthuizen J., 2003. *Water, works and wages.* Ph.D. Thesis, Wageningen Agricultural University, Wageningen, The Netherlands.
8. Ostrom, E., 1992. *Crafting institutions for self-governing irrigation systems.* Institute for Contemporary Studies, San Francisco, California, U.S.A.

9. Plusquellec, H., Burt,C., Wolter, H., 1994. *Modern water control in irrigation: concepts, issues and applications.* World Bank Technical Paper 246, Irrigation and Drainage Series, Washington D.C. The World Bank.

10. Salemi H.R., Mamanpoush A., Miranzadeh M., Akbari M., Torabi M., Toomanian N., Murray-Rust H., Droogers P., Sally H., Gieske A., 2000. *Water management for sustainable irrigated agriculture in the Zayandeh Rud Basin, Esfahan Province, Iran.* IWMI-IAERI, Iran

11. Sengupta, N., 1997. Diversity in participation, p. 75-81 in Shivakoti, G. et al (Eds.) op. cit.

12. Shivakoti, G., G. Varughese, E. Ostrom, A. Shlukla, and G. Thapa, (Eds.) *People and participation in sustainable development.* Bloomington: Workshop in Political Theory and Policy Analysis.

SOCIAL DYNAMICS OF WATER MANAGEMENT: TRADITION AND CHANGE

Sailen Routray[1]

ABSTRACT

Over the last couple of decades a broad range of participatory irrigation management strategies have become popular, one of which is community based water management (CBWM). This paper based on an ethnographic study conducted in central Orissa, India, tries to critically analyze the limitations of CBWM strategies by focusing on traditional water harvesting structures and systems surrounding tanks. It tries to study the social relationships involved in the communal water management systems surrounding tanks and the changes in the social dynamics surrounding them. Contrary to the popular and academic discourse these systems have strengthened over the last few decades along with the continuing dominance of all aspects of village life by the caste group of Kuluthia Chasas. Castes perceived to be at the bottom of the hierarchy like Panas face many disabilities in accessing water. But this dominance does not continue without contestation by the Scheduled Caste groups of Panas and Keutas. The changes in the social life of the villages are reflected in the way the 'tradition' of tank-based irrigation has evolved and the ways in which it gets challenged.

INTRODUCTION

Natural resources form the ecological basis of the productive mechanism of human society. In a world characterized by increasing resource scarcity, better stewardship of resources is called for. Of all the natural resources, water is the most critical and its proper usage is essential for any process of sustainable development. One of the key approaches towards this end has been an institutional approach according to which sustainable and appropriate institutions are the single most important factor in ensuring sustainable management of natural resources, especially that of water. Thus, according to this approach nursing and crafting of institutions become singularly important (Ostrom 1996).

1- Ph.D. Scholar, National Institute of Advanced Studies, IISc Campus, Bangalore, PIN – 560012. Telephone: 91- 80 – 22185000. Fax: 91 – 80 – 22185028. Email address: sailenroutray@gmail.com

But natural resources are not merely ‘natural’; they are also ‘social constructs’ that can be seen not only through institutions but also through all the other facets of societal existence. Therefore, locating the use (and abuse) of natural resources in their social context and an examination of the social dynamics involved in their management can throw light on the multifarious ways in which nature and society influence and order each other. This is principally so because constructing stable processes of extraction of natural resource of any kind needs a certain amount of social consensus that facilitates this process (Baviskar 2003). Over a period of time this consensus gets translated into tradition.

THE OBJECTIVE AND METHODOLOGY OF THE STUDY

This study took place to interrogate and unpack the concept of tradition in the context of water management regimes in the commons. The study had three principal objectives: the first objective was to study the various traditional water harvesting structures and water management systems in selected villages; secondly to study the social relationships involved in these water management systems; finally to study the changes in the social dynamics surrounding them.

The methodology followed was primarily qualitative in nature. Ethnographic work was undertaken in four villages and the fieldwork took place in the summer of 2003. The villages were chosen based on their caste composition and size as preliminary studies revealed these factors to be the most relevant for the study. The methods of long interviews, group interviews, and focus group discussions were administered with individuals and groups identified as being important for the purpose of study. Base level socio-economic data was generated for the four villages by using stratified random sampling using caste membership as the basis of stratification.

LOCATION AND GENERAL PROFILE OF THE VILLAGES

This study was undertaken in four villages of Dhenkanal district in the state of Orissa in Eastern India. These villages were chosen with the help of an NGO, Foundation for Ecological Security (FES). Dhenkanal district lies at the edge of the coastal plains of Orissa and has an area of 4595 square kilometers. According to the 1991 census it has a population of 9, 47,770 the majority of which lives in rural areas (Government of Orissa 2002). It has an average annual rainfall of 1421.2-mm and enjoys an average of 73 rainy days per year. The River Brahmani and her tributaries drain most of the district and apart from the narrow valley of the river the land is mostly undulating. The district has no major irrigation scheme; most of the land is irrigated through minor irrigation works such as tanks and diversion of hilly streams (Government of Orissa 1972).

The population of the villages is mostly Hindu with Kuluthia Chasa as the most numerous and dominant caste group. They are the biggest landowners, own the most amount of irrigable land, and dominate the economic life of the villages and the region. Very few of the Kuluthia Chasas are landless agricultural labourers. The proportion of the landless is the highest amongst the Scheduled Castes. The other numerically important castes are Gauda, Pana and Keuta. The Panas have the largest population amongst the Scheduled Castes and still suffer from taboos like lack of access to places of worship and communal wells. Untouchability, restrictions regarding caste endogamy and commensality are still strictly practiced.

Agriculture is primarily rain-fed in the villages. The cultivated land is divided into two major categories: *bila* and *toila*. *Bila* is land that is cultivated every year as it is generally low lying and of good quality. *Toila* is inferior quality land that is periodically laid fallow. Paddy is the principal crop with more than eighty percent of all cultivable land being devoted to it. Pulses, sugar cane and oilseeds are the other major crops. Apart from agriculture forests play a major role in the livelihood of the villagers.

Agriculture forms the basis of the economic and social life in the villages and most of the agricultural practices revolve around the monsoon paddy cultivation. Other important crops include groundnut, green gram, horse gram, and black gram dal. Despite gains in productivity over the last few years and its continuing importance as a source of subsistence, the importance of rice as a commercial crop has decreased due to declining profitability. Over the last three decades the cultivation of coarse grains has decreased in importance. Due to the increasing cost of labour, cultivation by owner-cultivators and sharecroppers is of increasing importance. There is no mechanization of agriculture and chemical fertilizers and pesticides are used in minimal amounts.

Other modes of livelihood are becoming increasingly important. More than a quarter of the population surveyed in the four villages do service sector work along with agriculture and see it as a significant part of their livelihoods. People are increasingly taking recourse multiple livelihood strategies and older caste-based modes are weakening.

The landholding pattern has a very high correlation with caste and most of the landless are from the Scheduled Castes. Assured crop saving irrigation over the years might have helped the dominant Kuluthia Chasas to consolidate their power over the villages' political, social-economic structures. There has been some change in the ownership pattern of irrigable land: in none of the four villages the various Scheduled Caste groups have gained ownership of such land to any substantial extent; in a couple of villages significant alienation of land by the Panas seems to have taken place.

Growth of sharecropping in the area under study is also a factor in the changing occupational pattern in the villages. The increasing incidence of sharecropping means that now more people have access to land and an increasingly heterogeneous group of people have a stake in the communally managed tank based irrigation system. There seem to be significant relationships between land ownership, caste, the agricultural system and participation in the water management systems in the villages.

In the villages forests form the ecological basis of agriculture. They provide firewood and fodder and make it possible for crop and animal residue to be used as manure by providing for fodder for domestic animals. Forests also protect the catchment area of the tanks. The institutions that are implicated in the governance of forests are also implicated in the governance of water bodies.

KEY FINDINGS

INSTITUTIONS HAVING RELEVANCE FOR MANAGING WATER

The term institution has very structuralist connotations whereas it need not be so. Institutions are different from organizations as they are rules for ordering social action; organizations are groups of people bound by some common purpose (sometimes by common ideology) to achieve common goals. All organizations presume the existence of institutions whereas all institutions need not presume the existence of organizations (Leach, Mearns, and Scoones 1997). An institution can exist in the form of a code, a set of rules or a pattern of organizational behaviour. It is this ambiguity in the usage of the word that allows us to attach the word to diverse social entities. One needs to bring this sociological understanding of institutions to study the management of water.

The village management committee is the most important institution in the villages. It is a nominated body selected by all the adult men of the village and is composed of important representatives of all major caste groups and representatives to the statutory village council from the village. It does not enjoy any legal status and the basic rights and duties of the village management committee are similar across all the villages. These duties involve maintaining village commons like tanks and forests, taking up developmental work like schools and roads, building temples, resolving disputes between various individuals and groups in the village, and maintaining civil amity. It is the most important institution in the village for the management of village resources in the commons, including that of water. Management of the village tanks is one of the most important functions of the village management committees as the annual auctioning of fish from the tanks forms the single biggest source of revenue for them. Most of this amount is spent on the maintenance of these tanks and the water distribution systems and in fulfilling other duties already mentioned.

The significance of the management of tanks by the committee goes beyond the realms of economics. Most of these committees are dominated by Kuluthia Chasas. In the villages a non-Kuluthia Chasa has never become the President of a village management committee. Most of the Schedules Castes are either landless or don't own irrigable land and temple entry is still denied to them. Most of their children drop out of school before completing primary schooling. Thus, one needs to probe the kind of role played by the village management committees through their domination of water bodies as well as of the exclusive nature of the "new village commons" such as schools and temples that are being constructed by them.

The statutory village councils have had a significant bearing on the working of the water management system of the villages. The transfer of ownership of a number of village tanks from the villages to statutory village councils in the mid-seventies of the last century was one of the most significant events in the historical evolution of tanks. A steady flow of funds for the development of tanks through the statutory village councils has taken place. These bodies are the most direct way in which the state system interacts with the villages. The steady flow of funds into the tanks perhaps hints at the fact that despite being ignored by formal policies and plans of the state, local politics has performed a role in keeping some focus on the tanks. These funds are not adequate but significant.

The statutory village council and the village management committee share and contest for power over the water resources of the villages. When the village is a significant player in the statutory village council because of its size or its political influence, the village management committee it is able to influence the statutory village council for getting funds for the tanks. The power of the statutory village councils seem to be inversely proportional to the power of the village management committees of the villages that constitute it.

The hamlet committee is a formal body in only one of the villages under study. Elsewhere these committees take the shape of an informal neighbourhood group of men nominated from amongst the various households inhabiting the hamlet. Hamlet committees manage the largest number of tanks and the challenge to the dominant caste group also manifests itself in the neighbourhood groups. In one village, for example, traditional fishermen inhabiting a specific hamlet have been able to form a fishery cooperative in a village tank owned technically by the government that had been till then been controlled by the village management committee dominated by Kuluthia Chasas.

All the caste groups in the villages have caste councils at the village level. These caste councils set rules of behaviour for married couples, arbitrate domestic fights, settle disputes amongst fellow caste members, take political decisions during elections, and collect fines for transgressions of caste rules and for not obeying its orders. Quite a number of the hamlets are inhabited on the basis of caste. Thus the caste panchayats assume a role in the management of tanks owned and managed by the hamlets.

The institution of *bethi* (or forced communal labour) is one of the critical institutions in the communal management of water resources in the villages. The institution is used to manage resources like water and forests communally and to create communal assets like schools, village roads. Its origins lie in the mandatory labour that the villagers had to do for the king of the erstwhile princely state of Dhenkanal without payment. Any household that cannot contribute labour has to pay the corresponding wages to hire labourer(s) for the task involved.

Foundation for Ecological Security is an NGO that has been working in the villages for the last five years or so. It has been trying to regenerate forests and restore communal tanks under the control of the villages in the area under study. In the process it has invested in the common village forests and five tanks in the four villages. It has chosen to work with the village management committees in its work for ecological regeneration and has been working to strengthen them for the effective management of the village commons. The amount of funding routed to the villages by it is less than the total governmental funding over a comparable period but its most important impact has been the way it has been able to add to the legitimacy of the village management committees.

Many institutions seem to have grown together. The institutions of *bethi* and the village management committee, or example, seem to have gained in strength simultaneously over the last few decades. In fact both of them can be seen in the form of continuing Kuluthia Chasa domination.

IRRIGATION AND COMMUNITY BASED WATER MANAGEMENT

The water resources of the village primarily consist of tanks and wells. The tanks are communally owned by the village, by the statutory village council, or by various hamlets or by clusters of households. Most of the hamlets and clusters of households are inhabited or dominated in terms of population by Kuluthia Chasas. In terms of both ownership and nature, water resources of the villages can be divided into six categories; communal tanks managed by the village committees, tanks managed by hamlets, tanks owned by individuals, communally owned wells and tube wells, tube wells owned and accessed by particular caste groups and hamlets and tube wells and wells owned by individual households. The most important category of water resources are those of communally owned and managed tanks. More often than not these are the largest tanks in the village and have received the most amount of attention from the village management committees. Most of the wells in the village are privately owned and more than ninety percent of these belong to the Kuluthia Chasas.

Tank-based irrigation is the principal mode of irrigation and irrigation from wells or any other sources is insignificant. Use of groundwater for irrigation is minimal and canal-based irrigation is virtually absent in the region and non-existent in the villages. Irrigation is generally done to save the monsoon paddy crop from total failure.

One of the clichés in the discourse surrounding water bodies in the commons is the notion that the last few decades have seen constant erosion of the physical capacity and the management base of the tanks. Contrary to such a perception, in all the four villages under study, tanks are still significant in the life of the community, especially for irrigation, drinking water and bathing; the last three decades have seen the growth of cultivation of high yielding varieties of rice and a resultant increase in rice production. Most of the productivity gain has been due to greater use of the water resources of the tanks. Since wetland rice cultivation has replaced the less water-dependent coarse grains over the same period, this could not have been possible without an absolute and significant increase in the capacity of the tanks and their better management.

Tanks seem to have grown in size, number, and efficiency over the last four decades or so. But the histories of individual tanks seem contingent on a lot of factors. Due to the scarcity of resources, the tanks that are critical or are perceived to be critical by the dominant social groups in the villages (for the purpose of irrigation and for usage in summer) have received attention. The majority of the tanks are generally neglected, but the tanks that do get attention seem to be receiving them constantly over a period of time and these are also the tanks that are ecologically, socially, and economically the most important.

Access to water and water bodies is one of the most concrete ways in which caste ideology is operationalized. For example, the scheduled caste groups have different bathing spaces in the tanks and are still not allowed to access communal water bodies like communal wells or tube wells. Panas are excluded from all the rituals that take place in the village for propitiating the gods for water during periods of water stress. In terms of the sheer quantity of water used irrigation is the principal consumer. Increased irrigation through efficient tank management systems might have contributed to the continued dominance of the villages by the Kuluthia Chasas as they own the most amount of irrigable land in the village. This short discussion points at the importance of water as a “social resource”’

CONFLICTS OVER WATER

All these institutions are created out of the material-historical process of evolution of the village society. In the villages conflict is an essential part of this process and the resources of the village, principally the village forests in the commons and the tanks, are a site as well as causes of contestation and conflicts. Conflicts over water are of a constant nature and these conflicts can be looked at and analyzed in a variety of manners; one of the ways of doing so is by looking at the various parties to the conflicts. Conflicts can be between individual households, between households and hamlets, between two or more hamlets, between hamlets and villages, between an individual and the village and between two or more villages. The more persistent conflicts seem to be between hamlets of a village with the village, and the ones between villages; but that does not mean other kinds of conflict are either insignificant or absent.

Conflicts over tanks have a significant underpinning on caste related issues. In one of the villages, one of the most significant sets of conflicts that have got converted into fights has been the right to fish in the tanks. One has to keep in mind that fishing in the tanks is the most overtly commercial activity and this process of commercialization may have possible linkages with the heightening of conflicts. But these conflictual situations have also given vulnerable caste groups the opportunity to challenge the power of the dominant caste group. Conflicts over tanks and water management systems have to be seen in terms of the wider social conflicts that are a part of the process of social change. The conflicts over the tanks precipitate conflicts in the overall social life of the village whereas sometimes the water management system in general and the tanks in particular become the sites of struggles for dominance and resistance.

CONCLUSION

A common theme of harmony, equilibrium or balance between community livelihoods and natural resources underlies the various approaches to community based sustainable development approaches. A related and widely held assumption is that such a harmony existed till it got disrupted in recent times (Leach, Mearns, and Scoones 1997). One of the common observations from the villages under study is that such equilibrium and harmony has, perhaps, never existed, as the communities in question have always been divided along the line of class, caste, and gender.

The village resources, including tanks, have been the sites of contestation and conflict. Conflict *and* negotiation rather than conflict *or* negotiation is the patterns surrounding water disputes in the villages. These resources have been dynamic in nature and have been continuously shaped and produced by actions of social actors having conflicting agendas, some of which are intentional and affect these water management systems directly. But there are important changes that are produced by unintended consequences of policies of the state and the actions of other actors.

Contrary to popular and general academic perception, there has been an actual growth and strengthening of tank-based irrigation systems in the villages and this is linked to the continuing dominance of particular caste groups like the Kuluthia Chasas. But this needs to be qualified by the fact that amongst the villagers there are no standard definitions of success and failure as these villages are fairly heterogeneous. Various social actors contest the notion of success and failure and question their nature and content.

Multiple institutions having a multiplicity of social roles affect water management and this institutional multiplicity helps different social actors in making their claims. It must also be noted that the formal/informal dichotomy in terms of analyzing institutional frameworks for resource management is not fruitful in explaining the logic behind the actions of various social actors. Any particular resource management system cannot be equivocally said to be either traditional or modern; but tradition is an important part of this process as most institutions draw upon 'tradition' to maintain and further their legitimacy. Tradition in this context can be seen more in terms of a framework of symbols and ideas from which different social actors draw their legitimacy; what matters is not what *is* traditional but what can be successfully *claimed* to be traditional.

The creation of such complex institutional frameworks is not necessarily a smooth process. In fact social conflicts over natural resources can be seen as the ways in which these resources could be utilized in the long term with some semblance of equity. Most of the frameworks looking at natural resources see asymmetries of power in accessing natural resources through the binaries of 'state v. community' and 'tradition v. modern'. But as this analysis shows, the process of understanding and intervening in resource management might more fruitfully start with interrogating these categories and by engaging with the complex and contingent nature of political identities of most communities. This might go a long way in helping us to productively retheorize natural resources and natural resource management in the commons.

REFERENCES

1. Baviskar, Amita. 2006. For a Cultural Politics of Natural Resources. *Economic and Political Weekly*, 38: 2159 – 2169.
2. Council of Professional Workers. 1994. *Survey of Orissa's Environment 1994*. Bhubaneswar: Council of Professional Social Workers.
3. Government of Orissa. 1972. *The District Gazetteer of Dhenkanal*. Bhubaneswar: Institute of Gazetteers, Revenue Department, Government of Orissa.
4. Government of Orissa. 2002. *Dhenkanal District Statistical Handbook*. Bhubaneswar: Government of Orissa.
5. Leach, Melissa, R. Mearns, and R. Scoones. 1997. Challenges to Community Based Sustainable Development. *IDS Bulletin* 28: 4-13.
6. Ostrom, Eleanor. 1996. *Governing the Commons: The Evolution of Institutions for Collective Action*. New York: Cambridge University Press.

INSTITUTIONAL REFORMS IN IRRIGATION SECTOR - A SUCCESS STORY

S.M. Taley[1], S.M. Belsare[2]

ABSTRACT

In light of the past experiences and future options, State Agricultural University (Dr. PDKV) Akola, Irrigation Division, Akola and Sinchan Sahyog, (Voluntary organization) Akola are continuously working jointly from last 5 to 6 years to modernize the existing irrigation systems operations through the network of Water Users' Associations mainly in the command of Katepurna Irrigation Project and also other irrigation projects in the Akola district. Initially with poor water utilization scenario, efforts were made to identify worst affected situation. Accordingly strategies have been finalized and adopted to solve the problems and to improve the water utilization scenario in the Katepurna river Irrigation Project and also in other irrigation projects in Akola district, step by step. In Akola district the total irrigation potential is around 21,530 ha with live storage of 199.25 Mm^3. At present in the district, 38 registered WUAs are working, covering the area to the tune of 9203 ha which is 43 per cent of the total command area. The irrigated area in Akola district is increased from 6626 ha to 122269 ha with water saving of around 15.50 Mm^3. This could only be possible due to the improvement in the irrigated systems operations, involvement of WUAs and awareness created amongst the beneficiaries. On the strength of achievements in the Akola district, it is inferred that irrigation management transfer to the project beneficiaries will lead to sustainable agriculture, efficient and economic use of water. Considering the outcome of these efforts Government of Maharashtra has reformed the irrigation sector by bringing in force the new irrigation act as," Participatory Irrigation Management by the farmers in Maharashtra State-2005."

INTRODUCTION

Historians have recorded about the voluntary participation of farmers in management of irrigation systems constructed during 13th – 16th century A.D. on Tungabhadra river in Vijaynagar Empire. During the British period modern Western system and practices came to prevail in the sphere of governance. The Government expanded its role and

1- Project Engineer,Large Farm Development Project, Dr.PDKV, Akola.444104(MS) India
Email: Smtaley@indiatimes.Com, daeec@pdkv.mah.nic.in Phone: 00-91-724-2420268 ®
00-91-724-2248138 (off.) Fax. No. 00-91-724-2258219. Moblle: 91-9822723027
2- Upper Secretary, Irrigation Ministry, (Mantralaya) Government of Maharashtra State, Mumbai, INDIA

took over many functions, which were earlier performed by the community. This later led to the perception that only Government is capable of managing irrigation system, especially large ones. However, in the part decade there has been a growing recognition of the need for reviving growing recognition of the need for reviving active participatory of the farmers irrigation management, which is now popularly known as management, which is now popularly known as participatory irrigation management (PIM). Those irrigation systems, whose management has been taken over by the legally constituted farmers, association, have shown significant improvement in their functioning. When the farmers clearly become the owners of the physical system, they have strong incentive to protect the system to reduce their management costs. Once irrigation management gets improved with user involvement, they may be

willing to pay more for improved services. In light of these past experiences and future options of these past experiences and future options efforts are being made to irrigation management transfer (IMT) to the farmers. Through the network of WUA's in the command. The strategies adopted by involving the farmers and the achievements of this joint venture of Agriculture University, (Dr PDKV, Akola) State Irrigation Deptt. and Sinchan sahyog, Akola (Voluntary Organization) over the period of 5 to 6 years have been discussed in this paper.

NEED AND PERSPECTIVES

Water resources development such as formulation, evaluation, gradation, scheduling, operation and management must have two way interaction between end users and specialized agencies in all the stages of development. This is essential because the planner may have to select the plans according to the practicability, ground truths and aspirations of the people to satisfy requirements of the community. It is also essential that the end users should be aware of the various alternatives that the government or the planner have and what their implications are? The public input by way of ideas, opinion and value judgement in the water resources sector has been rather slow. Involving NGO's in the decision making process would ensure and impartial advice to the government on many intricate problems besides inspiring confidence which is at present lacking to tackle various issues particularly related to the environment

It is also essential to involve common people in various water related activities to overcome various social and environmental problems in it's proper development and management. Thus the people can be involved in the process of generating information base of the rural resources like field identification and verification through a guided exposure. Then the exercise itself may give an insight, for the people regarding the problems in a society and the present land use system and interactions. People's involvement in the process of monitoring the natural resources through such service motivate them to arrest drift resulting from the defective interactions. It can be a positive people's programme.

Normally there is scarcity of intelligence people taking interest in the project from the point of view of public. Hence their contribution at a desired level is not expected to come automatically. For increasing the efficiency of water resources project to society and for larger interest of the project, mechanism has to be developed to involve more people who can think and contribute. The might of thinking people should be harnessed by channelisation and organized efforts to get them interested. Things can not be left to initiation and enthusiasm of individuals for positive progress.

Those irrigation systems, whose management has been taken over by the legally constituted farmers, associations have shown significant improvement in their functioning. When the farmers clearly become the owner of the physical system, they have strong incentive to protect the system to reduce their management costs. Once irrigation management gets improved with users involvement, they may be willing to pay more to improved services. Contributing to these goals, purpose of this study is to strengthen the knowledge based on water-agriculture environment and promote its use in developing consensus on investment strategies.

STRATEGIES ADOPTED

ENGINEERING MEASURES

REPAIRS OF CANAL SYSTEM

Canal system rapairs were carried out systematically as per priority according to, availability of funds with irrigation department and beneficiarie's requirements. At the outset bottlenecks were removed, important canal structures such as syphon, other heavy leaking structures were repaired, selective canal lining was carried out for short length, service road were also repaired for better transportation.

IRRIGATION SCHEDULING

Earlier, there was no control on irrigation rotation, farmers at head, used to take water as and when required and tail enders had to suffer. This practice led to improper distribution, waste of water and disharmony among farmers. Irrigation scheduling, prepared with tail enders to receive water first and head reach farmer at the end. The scheduling has been followed strictly. Scheduling was prepared by considering water requirement and soil type. This practice enabled farmers to have assured, adequate and timely supply of water. Earlier, beneficiaries were not taking water in night, leading to heavy wastage of water. Now night irrigation is made compulsory and practiced strictly, due to which huge quantity of water is saved.

VOLUMETRIC MEASUREMENT OF FLOW

Earlier, water rates were charged on area basis, thus there was no tendency on farmers side to use water efficiently. Now the flow measuring devices are installed at the head of canal for measurement of the canal discharge. The supply of water to water user association is being made on volumetric basis, with □ubsidized water rate structure, which resulted in efficient, effective and economic use of water. A two days training program was organized during 28th-29th Jan. 2000 for irrigation officers and irrigators on flow measurement in collaboration with Water and Land Management Institute, Aurangabad.

IMPROVED SURFACE IRRIGATION METHODS

Considerable wastage of water occurs due to wild flooding and other uncontrolled surface methods. The on-farm irrigation efficiency could be as low as 40 to 50%. In such cases use of proper irrigation layouts is essential. The farmers are trained and encouraged by demonstrating the efficiency of such border, furrow, basin etc. layout to farmers by conducting on farm training. As a result now farmers in command are adopting improved surface irrigation methods properly and effectively.

AGRONOMIC MEASURES

Integrated approach of irrigation and Agricultural University at field and administrative level is adopted which helped in water saving.

APPLICATION OF WATER AT CRITICAL GROWTH STAGES OF CROPS.

With the support of agricultural University farmers were educated in the application of right amount of water at right time which has reduced the number of rotations and ultimately minimized over application of irrigation water which is further found useful to maintain the proper drainage of the land under command.

CROP DIVERSIFICATION

ON FARM DEMONSTRATIONS

Katepurna command constitutes around 39% of cotton crop but farmers were reluctant to practice irrigation for cotton. With integrated efforts of Agricultural University, Agriculture and Irrigation department promoted farmers to take pre monsoon cotton. It has given 1.5 to 2 times higher yield than traditional cotton growing and now there is trend set for pre monsoon cotton growing among farmers.

ON STATION DEMONSTRATIONS OF COTTON AND OTHER CROPS (AKOLA COTTON DEMONSTRATION PROJECT)

During the year 1996-97 one of the prestigious Akola Cotton Demonstration Project was also launched at University farm in the command of the Katepurna River Irrigation Project on 120 ha and in the command of the Morna River Irrigation Project on 86 ha, in collaboration with Government of Maharashtra and Israeli experts. The water management technique for pre monsoon cotton through drip irrigation was demonstrated to about 1 lakhs farmers of Maharashtra State and out side.

Due to on farm and on station integrated efforts the area 352 ha sown under pre-monsoon cotton in the Katepurna River Irrigation Project during the year 1998-99 was increased up to 413 and up to 474 ha during the year 1999-2000.

SOIL AND WATER TESTING LABORATORY

The Agricultural University and Irrigation Division Akola, established the separate soil and water testing laboratories and providing the testing facilities to the farmers to know soil and water properties, so as to plan the cropping system and water management practices scientifically.

MANAGEMENT MEASURES

PROMOTION OF PARTICIPATORY IRRIGATION MANAGEMENT (PIM) BY FORMULATING WATER USER'S ASSOCIATION (WUA)

Katepurna River Irrigation Project's beneficiaries were motivated, trained and convinced towards importance and need of water user associations. The special privileges are given to form WUA's appropriate and proper situations and atmosphere has been created to form the WUA's as a result water management in 87 per cent area of the command taken over by the WUA's.

IMPROVED MANAGEMENT AND OPERATION OF IRRIGATION SYSTEMS.

Better and reliable, irrigation management and operation practices followed, considering limitations of the system, farmers' requirement and efficient use of water. Field level, minor & distributory level and project level co-ordination between project authorities and farmers striked to enable improved management. Project level co-ordination committee has been formed with the representatives of WUA's to plan, co-ordinate and monitor irrigation programme. Beneficiaries were involved in decision making and real management of project.

INVOLVEMENT OF WOMEN IN IRRIGATION MANAGEMENT

For sustainable agriculture, involvement of women farmer is essential. Various studies indicated that for promoting water savings on the farm, women involvement is must. Two days on farm women's training program. 3rd -4th January 2001 has been conducted on water application techniques, management of water distribution system, Water user's associations formulation and functioning etc. Women farmer has shown enthusiasm to hold the responsibility of the Water User's Association.

TRAINING/CAPACITY BUILDING

Capacity building of project personnel as well as farmer is imperative for better co-ordination, implementation, operation and management of irrigation systems. Adequate training and motivation imparted to irrigation personnel and farmers representative with the help of Agricultural University, Akola, Water and Land Management Institute, Aurangabad as well as Sinchan Sahyog, Akola. Incentives were given to Irrigation officers as well as to WUA's for their better contribution. On-farm training were conducted for both farmers and project personnel. Field visit were organized to share experiences of successful Water User,s Association.

Lectures were delivered to the primary school teachers towards strategies to be adopted to conserve water and for judicious use of water. About 1000 primary teachers from Akola districts were attended the lectures at their respective taluka places. Teachers were requested to decimate the information for the knowledge of the primary students.

PUBLIC AWARENESS AND INVOLVEMENT

Awareness regarding the need for water conservation/ saving should be promoted involving all stakeholders including community group, political leader, farmers and specially school children mass education through media, posters, Video tapes, public debater, T.V., Radio, New papers is found to be effective in motivating people to reduce water wastages. An attempt has been made by conducting/performing following programs.

ESTABLISHMENT OF NON-GOVERNMENT ORGANIZATION "SINCHAN SAHYOG" TO PROMOTE EFFICIENT

USE OF WATER

'Sinchan Sahyog' is a non-Government organization established at Akola to promote efficient use of water. Sinchan Sahyog is established with inspiration and guidance from Dr. Madhavrao Chitale, Ex Secretary General, ICID. The authors have taken lead in establishment of Sinchan sahyog, at Akola. The authors are shouldering responsibility as a office bearer of Sinchan Sahyog, Akola. Sinchan Sahyog working committee having representatives from agriculture, irrigation engineer, agricultural industrialist, seeds experts, economist, socialist, member of legislative assembly, media personnel and farmers. Broad objectives of the organization are to promote strategies of the efficient and effective use of available water resources, to undertake training program, to encourage people participation in irrigation management. The Akola center has contributed in educating training and providing solutions to framers. Sinchan Sahyog has taken active participation in promoting farmers to forms WUA and to adopt improved irrigation practices. Sinchan Sahyog, Akola had taken a drive in water literacy by organizing small workshop for farmers by demonstrating, educating water measurement and water accounting. To propagate Sinchan Sahyog mission on large scale, Sinchan Sahyog, Akola, a web site is hosted **www.sinchansahyog.org .**

AWARENESS CAMPAIGN

Formation of water user association and need of the efficient water utilization was propagated through newspaper, radio, exhibitions, pamphlets, posters to encourage farmers to participate in irrigation management Slogans on participatory irrigation management and efficient use of water were written on compound wall, canal structure, offices and public places, so as to promote collective action

KATEPURNA RIVER IRRIGATION PROJECT SILVER JUBILEE FUNCTION

A novel function was organized by beneficiaries of Katepurna river irrigation project, on eve of silver jubilee of the project. The beneficiaries felicitated the project-affected people for their sacrifice, engineers for their contributions. The project beneficiaries also felicitated the government, for giving the project, which had changed their lives, Indebtness ceremony on eve of Katepurna Silver Jubilee function was organized by beneficiaries to show sense of gratitude and attachment towards the project. It was unique gathering of society, government and media. Hon. Chief Minister of Maharashtra State chaired the function and congratulated for organizing a novel function. The Chief Minister also called for organizing such program at other project site to honour contribution of project in national development and to reiterate sense of part of the project. This function was appreciated from all corners of state. The author has played key role in conceiving and arranging the novel function.

CULTURAL GROUP

To motivate irrigators, cultural groups are formed from the irrigation department staff members and cultural program (songs, drama etc.) arranged at village level.

YOUTH AWARENESS

A four-day workshop was organized under National social service program in command area to educate students towards water literacy, canal operation and maintenance and Management etc. The awareness among youngsters could lead to better future in water saving.

ORGANIZATION OF MAHARASHTRA IRRIGATION CONFERENCE 2001

A two day state level conference was organized at Akola during 20^{th} to 21^{st} January 2001, with theme 'Irrigation in 2000'. The conference was devoted to irrigation management, development in farming system, water literacy and women participation. The conference attended by Hon. Ministers, Vice Chancellor's of State Agriculture Universities, Secretaries, Policy makers, Scientist, Irrigation engineers, Agricultural officers and farmers. The attendance for conference was overwhelming with around 500 participants from different disciplines on one platform. The message of water conservation was wide spread in region after conclusion of conference. It was for the first time such a large gathering was organized in region on issues of water conservation.

AUDIO CASSETTE/C.D./ BULLETINS

Title as "Way to prosperity" the audiocassette comprising of song on efficient use of water, crop diversification, participatory irrigation management released on professional level. The song were written and sung by staff members themselves. The cassette has been proved very effective in propagating message among farmers, as it is prepared in local language and traditions. The bulletins were written and distributed amongst the farmers which gives the information about the new irrigation act regarding the participatory irrigation management by the farmers in Maharashtra State - 2005 with other need base related technical information about irrigation and drainage systems to be adopted, water measurement on volumetric basis, application of right amount of water at right time as per the need of the crop, etc.

FILM ON SUCCESS STORY OF PIM IN KATEPURNA

A film was made on “Success Story of Katepurna Irrigation Project”, highlighting participation of beneficiaries in irrigation management could lead to miracle. The film was displayed during village level meeting as well as through cable network and state television network. This film proved to be very useful in convincing the beneficiaries of other project to form WUA to save water and earn more.

IMPACT / ACHIEVEMENTS

Information depicted in table 1 and 2 indicates the significant change in the water utilization efficiency and the area under irrigation particularly after persistent strategic efforts towards modernization of the irrigation system operations and participatory irrigation management from the year 1996-97 and onwards. If we look critically to the data on table-2 it is observed that from the year 1997-98 onwards average area under irrigation in the command of Katepurna irrigation project increased from 2027 ha to 3646 ha. with yearly water saving of around 7.71 Mm^3 . Data in Table-3 also indicates that during the year 2000-01 there is a record irrigation of 5940 ha with almost complete utilization of irrigation water in the Katepurna reservoir. From the year 1975-76 to 2000-01 data in table 2 indicates that the project achieved irrigation potential equal to its present potential with 86 percent of the live storage in the reservoir. The benefits were extended from 2000 to 3970 number of beneficiaries. During the year 2000-01 the yield of cotton and wheat crop in the command area were satisfactory, to the tune of 1.2 billion which is very high than the previous years. Government of Maharashtra took the serious note of the strategic movement implemented in Katepurna Irrigation project and decided to focus the facts to the other projects in the state. Katepurna Irrigation Project is now declared as a ‘Pilot Project’ in the state. Looking to the achievement of these strategic efforts Government has made the institutional changes and reforms in irrigation sector by bringing the new act as," Participatory Irrigation Management by the farmers in Maharashtra State-2005."

Table1: Year wise irrigation and water used in Katepurna Project

Sr.No.	Year	Season wise irrigation in ha.				Season wise water used for irrigation in Mm^3				Non irrigation water use Mm^3	Max. storage in project Mm^3	Water balance of the end of year. Mm^3
		Kharip	Rabi	Hot-weather	Total	Kharip	Rabi	Hot-weather	Total			
1	**2**	**3**				**4**				**5**	**6**	**7**
1	75-76	2	1485	2	1489	0	9	1	10	0.46	86.35	49.96
2	76-77	111	1745	267	2123	2.25	13.95	8.01	24.21	2.62	86.35	56.81
3	77-78	9	1213	289	1511	0.50	9.70	7.17	17.37	10.06	86.35	58.76
4	78-79	5	656	93	754	0.30	5.25	2.79	8.34	12.04	86.35	35.09
5	79-80	0	532	10	542	0	4.26	0.03	4.29	12.57	86.35	68.86
6	80-81	0	1209	9	1218	0	9.67	0.03	9.70	12.46	86.35	63.09
7	81-82	0	1624	40	1664	0	15.99	0.17	16.16	12.32	86.35	16.08
8	82-83	13	1677	347	2037	1.19	15.09	22.28	38.56	12.54	86.35	14.77
9	83-.84	0	954	387	1341	0	13.65	27.07	40.72	12.73	86.35	29.40
10	84-85	0	0	0	0	0	0	0	0	13.77	19.11	5.4
11	85-86	79	1515	355	2317	1-90	21-55	7.02	30.47	18.49	81.25	0.79
12	86-87	372	2936	1126	4434	4.76	38.05	25.03	67.84	15.97	79.50	13.22
13	87-88	175	3706	108	3989	5.00	30.00	1.00	36.00	21.06	62.34	11.94
14	88-89	0	1530	1313	2843	0	24.10	18.16	42.26	18.55	86.35	41.35
15	89-90	0	1150	764	1914	0	28.59	14.90	43.49	17.34	86.35	2.94
16	90-91	0	737	853	1765	0	11.43	17.99	29.42	15.19	86.35	14.5
17	91-92	2000	433	126	2559	10.77	1.39	4.00	16.16	19.55	41.50	16.05
18	92-93	0	999	1074	2073	0	22.08	22.41	44.49	15.19	86.35	6.27
19	93-94	0	1419	700	2119	0	20.66	20.85	41.51	14.35	78.78	28.88
20	94-95	0	2511	791	3302	0	30.27	14.54	44.81	15.71	86.35	17.22
21	95-96	70	1791	130	1991	0.50	12.71	2.47	15.68	17.51	34.34	1.09
22	96-97	0	1739	830	2569	0	14.83	16.50	31.33	16.68	84.89	22.99
23	97-98	142	1295	630	2067	0.47	9.18	13.05	22.70	18.56	59.27	22.63
24	98-99	0	1454	882	2336	0	10.17	21.53	31.70	21.93	81.99	43.90
25	99-00	0	2098	595	2693	0	13.83	12.83	26.66	20.26	86.35	31.75
26	2000-01	1501	4081	327	5909	5.75	23.44	5.77	34.96	24.00	74.26	2.15

Table 2: Impacts of the modernization of systems operations and PIM.

Sr. No.	Particulars	Average Irrigation	Average Duty
1	Scenario during 1976-1997	2027 ha.	75.20 ha./Mm3
2	Scenario during 1998-2000	3646 ha.	117.20 ha./Mm3
3	Net increase in average Irrigation .	3646-2027 = 1619 ha.	
a)	Water requirement with previous duty.	1619/75.20 = 21.53 Mm^3	
b)	Water requirement with improved duty.	1619/117.20 = 13.82 Mm^3	
c)	Yearly average saving of water (a-b)	21.53-13.82 = 7.71 Mm^3	

STRATEGY IMPLEMENTED BY GOVERNMENT OF MAHARASHTRA STATE -

The new act includes the following few main strategies,

(1) Irrigation water will only be allotted to the WUA's on volumetric basis.

(2) A non member farmer of WUA's is not entitled to get water for irrigation in his individual capacity.

(3) Existing on farm (from minor onward) water distribution system should be get repaired first and then handed over to the respective WUA's. A maximum provision is of amount Rs. 2500 per hectare has been made for necessary repairs.

(4) WUA's who will pay the water charges before due date shall entitled for 5 percent rebate on the total cost of water.

(5) Area development project sponsored by Central Government and related cooperative WUA's will get Rs. 225 from Central Government and Rs. 225 from State Government for managerial expenditure. And associatations without area development projects will get Rs. 450 per hectare for managerial expenditure.

(6) For efficient and effective working of the co-operative WUA's Chief engineer and Deputy Secretary of the State Irrigation Department will act as a co-ordinator for respective divisions.

(7) Distributory in the area of co-operative WUA's will be managed and maintained by themselves. For this, for first five years, Rs. 60/- per hectare per year and then after up to 6^{th} year Rs. 50/- per hectare, on 7^{th} year Rs. 40 per hectare and on 8^{th} year Rs. 30 per hectare and ninth year Rs. 20 per hectare rate substitute will be given by Government to the WUA's.

(8) The existing rules and regulation as regard irrigation management transfer (IMT) and other related issues as per the irrigation act, 1976 has been modified in 2005.

IMPACT ON OTHER IRRIGATION PROJECTS IN AKOLA DISTRICT

The activities are also being undertaken in other projects in the district by the State Department of Irrigation, Akola. In Akola district major and medium in all 25 project are there having the irrigation potential of 21,530 ha. with live storage of 199.25 Mm^3. At present in the Akola district 38 water user associations are formed covering the area to the tune of 9203 ha which is 43 per cent of the total area. The actual irrigated area is increased from 6626 ha to 12229 ha with water saving of around 15.50 Mm^3 because of only the improvement in the irrigation system operations management transfer (Involvement of water user associations on large scale) and awareness created amongst the beneficiaries.

In second phase of the project it is planned to increase the present 43 percent area covered by water user associations up to 60 per cent of the total command area.

STAKE HOLDER PARTICIPATION

This movement of 'Sinchan Sahyog' is a joint venture of agricultural university, state irrigation and agriculture departments and other incline departments, chanellised and implemented by the 'Sinchan Sahyog' (NGO). All these stake holders including beneficiaries are actively participated with 'Sinchan Sahyog' (NGO) in modernization of irrigation system operations and reforms in irrigation sector in Akola district.

SUSTAINABILITY

In future the strategic achievements and developments observed with the various agencies and Sinchan Sahyog will help in piloting the extension of such activities in the similar areas of the state. The Maharashtra State Government has already envisaged this activity and made efforts in the right direction for modernization of irrigation system operations and reforms in irrigation sector. This comprehensive assessment of water management in command areas not only help in enlightening the importance of PIM but the water saved may help in increasing the irrigation potential in the command areas.

COMMITMENT

Organizations involved are totally working for the benefits of the farmers and creating general awareness amongst the users, youths, women and children with the view to economize the water use and increase the irrigation potential and conservation of natural resources.

ORIGINALITY AND INNOVATIVE IDEAS

Create awareness regarding water management keeping the objective of optimum utilization, directly and indirectly increase the irrigated area with increase in irrigation efficiency and crop productivity. Throsugh, which it is possible to enhance socio economic status of the farmers.

CONCLUSION

In light of above the outcome of the efforts made by the organization are concluded as under: Normally, there is scarcity of intelligent people taking interest in the project from the point of view of public. Hence, their contribution at the desired level is not expected to come automatically. For increasing the efficiency of water resources project to society and for larger interest of the project, mechanism has to be developed to involve more people who can think and contribute. The might of thinking people should be harnessed by channelisation and organized effort to get them interested. Things can not be left to initiation and enthusiasm of individuals for positive progress. In India enormous human resource is available which has never been taken into account for base level planning and development. Now, this is the right time to motivate people in water resources projects. Government agencies have failed to achieve their original target in every water resources development project only because of lack of accounting. Village people if properly motivated, are the most productive force for management and development. The motivation is possible by proper non government (NGO) activism with sound vision and knowledge. Impact of the activities of Sinchan Sahyog is found to be effective in motivating the people to reduce the water wastage and appropriate management of water resources.

IMPLEMENTATION OF ASSET MANAGEMENT PLAN (AMP) AS A PART OF IRRIGATION MANAGEMENT POLICY REFORM: A CASE STUDY FROM YOGYAKARTA SPECIAL REGION, INDONESIA

Sigit S. Arif [1], Erwin T. Sigit[2], Murtiningrum[1], Judy Kurniawan[1], and Basuki[1]

ABSTRACT

Following the Reform Program started at 1998, the Government of Republic Indonesia issued the presidential decree on Irrigation Management Policy Reform. This decree is considered as the first step to have good irrigation governance in the country. The reform is expected to change the top-down approach applied in the past to the irrigation management with characteristics of efficient, effective, democratic, participatory, transparent and accountable. The new water law and government regulation on irrigation management issued following the policy reform stated in one of their article that the Asset Management Plan (AMP) should be implemented in the country.

The AMP in Indonesia has started since 1995 when The Institute of Irrigation Studies, Southampton University, UK, Gadjah Mada University and the Yogyakarta Irrigation Development Project introduced the AMP program for irrigation infrastructure. Subsequently, in the fiscal year 2000, the World Bank supported application of AMP in all provinces in Java. Unfortunately, up to today, only two provinces, i.e. Yogyakarta and East Java are still consistent in implementing the AMP, although they faced some constraints. During its implementation, the university conducted the training program and provided computer software while the Provincial Irrigation Project supported the implementation fund. This paper aims to discuss implementation of AMP in Yogyakarta Special Region.

Recently about to a dozen of irrigation schemes in Yogyakarta Special Region have implemented the AMP program. Some positive responds came from farmers and the bureaucracy in both the lowest management (field level) and the top management (province and central government). However, the middle management bureaucracy (regency level) is still worried and pessimistic to implement the program. One reason was due to lacking and unclear opportunity to have enough operation and maintenance fund as a part of future investment of irrigation management in regency government level.

Keywords: Asset Management, Policy Reform on O&M, Yogyakarta

1- Department of Agricultural Engineering, Gadjah Mada University, Yogyakarta, Indonesia sigit@idola.net.id
2- Head of Irrigation Development Project, Yogyakarta Special Region, Indonesia

I. BACKGROUND

Following social and political reform started at 1998, the Government of Republic Indonesia issued some steps to reform water resources management in the country. In 1999 a presidential decree has been set out and afterward the new water law was issued in 2004. Article no 2 of the new water law states that water resources management should be more efficient, effective, democratic, participatory, transparent and accountable to precede sustainability of the system. This statement seems relevant to good water governance approach introduced globally during the last several years.

In relation to this issue, the government and some universities try to introduce several new technologies to be applied in water resources management including irrigation management. One of them is the implementation of the Asset Management Plan (AMP) for irrigation infrastructure. The AMP in Indonesia has started since 1995 when The Institute of Irrigation Studies (IIS) of the Southampton University, UK, Gadjah Mada University (GMU) and the Yogyakarta Irrigation Development Project introduced the AMP program for irrigation infrastructure. The first model of the AMP was the adaptation of asset management plan for the UK water supply to the irrigation infrastructure in Indonesia.

The first AMP model has then been developed further by the GMU. Some conceptual modification in its analysis process made it simpler and more accurate. The participatory approach has also been integrated during its development by including farmers' participation in data collection, data analysis, as well as decision-making process.

In 1999 the World Bank trough the Java Irrigation and Water Management Program (JIWMP) funded the introduction of AMP in five provinces in Java. However, up to recently, only two provinces, i.e. East Java and Yogyakarta Special Province, respectively are still consistent to implement AMP in irrigation management in their own irrigation area. Some others did not interest to continue to implement the AMP due to several reasons.

This paper aims to discuss the implementation of AMP in Yogyakarta, the strategies, results and constraints during the implementation process.

II. DEVELOPMENT OF CONCEPT AND STRATEGIES

2.1. CONCEPT DEVELOPMENT

Actually, the concept of AMP in infrastructure management is relatively a new concept. Following development of infrastructures, people want to sustain and improve the service of infrastructure performances and its management to which it has grown accustomed and value for money is demanded. New methodologies are needed to overview the objectives, options, benefits, and competitive needs and to resolve this into a comprehensive strategy for investment. Based on the idea of privatization process of water industry in England and Wales in 1989, the IIS of Southampton University, UK recommended adopting the AMP concept into irrigation management **(Davies, 1993).** There are some key similarities between irrigation management and water industry, besides some differences between them. In 1994, the IIS collaborated with the

Department of Agricultural Engineering of the GMU, Yogyakarta, Indonesia started to implement the AMP concept in Papah Irrigation Scheme in Yogyakarta **(IIS-ODA, 1995 and Welch, 1995)**. Concept of the early of AMP is shown in Figure 1.

In its early implementation, the AMP for irrigation management in Indonesia met some difficulties. The main constraint was that the different characteristics of irrigation management from UK water supply management. The irrigation in Indonesia has very low excludability compare to water supply. Therefore some adjustments had made to deal with irrigation management condition.

After its early introduction, the AMP has developed considerably since 1998 in accordance the increase of demand on transparency and accountability on irrigation infrastructure management. Improvements took place since 1995 to today can be classified into development of policy, concept, method, and software.

In accordance to the increase of demand on good irrigation governance, the AMP became a tool to provide transparency and accountability in irrigation management. During the policy reform, the implementation of the AMP was in line with spirit of reform in irrigation management therefore the AMP was legally mentioned in the Government Regulation no 77/2001 on Irrigation Management.

Besides it contributed for better infrastructure maintenance and rehabilitation, the AMP implementation provides a tool for dialog between Water Users' Association (WUA) and the government. This placed the AMP as an important component toward good irrigation governance as aspired by the policy reform on irrigation. In line with the further development of water resources policy in Indonesia, the asset management was getting more strategic position. Law no. 7/2004 on Water Resources stated that the asset management must be applied into water resources infrastructure.

From the early concept, some detail changes and improvements have taken place. The idea of privatization has been removed while the participation of Water Users' Association has increased. The cost model has built based merely on current survey result and neglected the historical cost data.

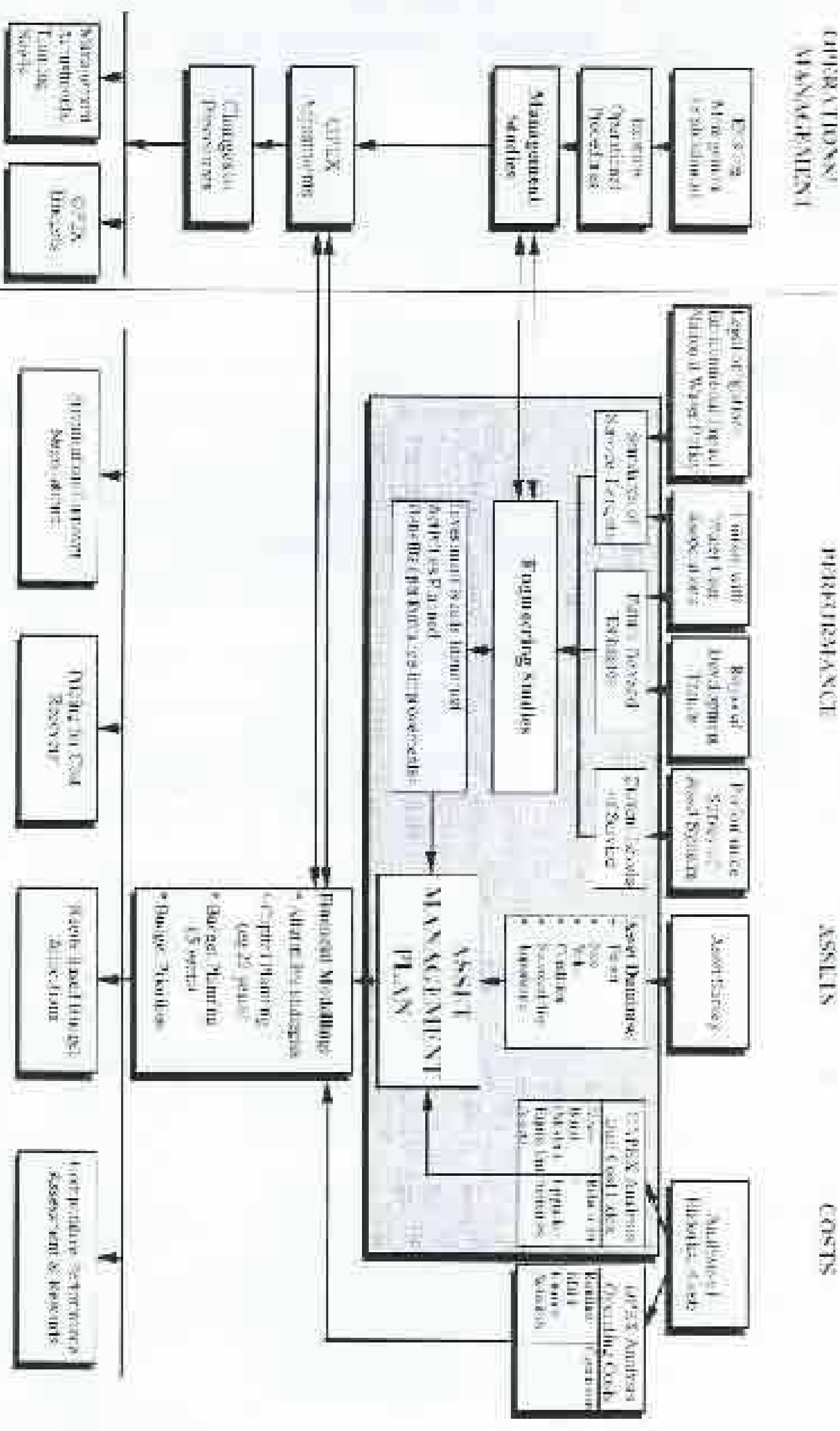


Figure 1: The early concept of Asset Management Plan (ISODA, 1995)

2.2. METHOD DEVELOPMENT

Besides the concept development, the AMP method has considerably developed. This includes method of data collection, computation, and linkage to other components of irrigation management.

Data collection and decision making in the asset management has essentially change from pure engineering judgment to combination among engineering, social, and historical aspects **(FTP-UGM, 2000)**. Participatory approach has been applied to accommodate farmers' opinion and experiences. This furthermore combined with the engineering assessment made by the government officers. Besides in the asset inventory process, this combination also takes place decision-making of infrastructure maintenance and rehabilitation while calculation process are fully computerized.

Other important method improvement was the determination method of priority of rehabilitation and maintenance works. The asset rehabilitation and maintenance are prioritized based on facet serviceability and condition, service area, and asset importance **(FTP-UGM, 2001**).

The asset management for irrigation infrastructure is a part of irrigation management. Therefore, functions of irrigation management were then attached to the main AMP program. As the responds from users' feedback, the AMP has been linked to module of operation, information, institution, water availability, and irrigation scheme prioritization **(FTP-UGM, 2002).**

2.3. SOFTWARE DEVELOPMENT

The early version of AMP program had been developed in very simple spreadsheet computation **(Davies, 1993 and IIS-ODA, 1995)**. The next generation has been programmed in a software application **(Adelina, 1996).** Only certain operators can operate these early versions.

Since 1998, the big improvements are made in the user-friendliness of the AMP program. The software has been developed in the database application with more advance algorithm and better appearance **(FTP-UGM, 2000 and FTP-UGM, 2001**). The user-friendliness in data entry, data validation, as well as result display has improved significantly. This user-friendliness helps users in farmer and regency level to use the program.

The integration of Geographic Information System (GIS) and photo viewer were the next improvement **(FTP-UGM, 2003**). The integrated GIS can show the asset and area position as the computation result. Furthermore, the photo of each asset can be shown easily. These software improvements are important for the executive in regency or province level to assist them allocates the maintenance and rehabilitation fund easily.

III. LESSON LEARNED OF THE AMP IMPLEMENTATION IN YOGYAKARTA

Yogyakarta, besides East Java, was the first province implementing the AMP. Adaptation of AMP from water industry into irrigation management was conducted in Papah and Pendowo Irrigation Systems **(IIS-ODA, 1995; Welch, 1995; Adelina,**

1996). The initial version of AMP has been developed continuously based on the results of its implementation.

So far the AMP has been implemented in more than thirty irrigation systems throughout Java Island since 2000 with the support from the World Bank. Most of the improved concept, method, and software have been developed in this period. During the AMP implementation, Gadjah Mada University conducted the training program for field implementers and provided computer software while the provincial irrigation project supported the implementation fund.

However, without funding support from outside, some provinces had discontinued its AMP implementation. Up to today, only two provinces, i.e. Yogyakarta and East Java are still consistent in implementing the AMP, although they faced such constraints as providing funding source for irrigation system maintenance as shown by AMP results.

Due to its long history in AMP implementation from its early introduction to recently, it is interesting to learn from Yogyakarta experiences of AMP implementation. The activities in each irrigation system started from introduction, training, implementation, and evaluation, which absorbed resources from the government budget. This reveals the intention of the province government to improve performance of irrigation management.

Recently about to a dozen of irrigation schemes in Yogyakarta Province have implemented the AMP program **(Arif et. all., 2001).** Review of the activity provides some lesson learned.

The development of irrigation infrastructures needs costly investments therefore good maintenance is definitely required. Poor maintenance results in poor irrigation performance and increase of its rehabilitation cost. However so far the maintenance cost requirement is manually calculated and selected based on proposals. Consequently there is a chance for subjectivity to exist. The AMP provides tool to objectively calculated and prioritized maintenance and rehabilitation works. As a result, the top management in province and central government appreciate the AMP as the tool for maintenance planning which is accountable and transparent.

The AMP has been introduced and trained to the middle management in regency level, field management, and farmers, besides to the top management. Feedbacks came from the field activities and decision making to improve the AMP method and software. In general the AMP has been accepted as a new form of technology.

Although the AMP has been proven as an objective and accurate tool to determine maintenance plan, in middle management or regency level do not use the AMP to plan their maintenance budget. This is due to the uncertainty of the available budget for the operation and maintenance of irrigation system in regency level. Available budget is mostly lower than the result of AMP calculation, which means the available O&M budget is actually inadequate. Therefore they prefer to use the manual method of O&M budget calculation.

In the field level, the AMP receives a positive respond from field officers and farmers. In accordance to their responsibility, the field officers experienced that the AMP make their daily task easier. To increase the effectiveness of the AMP to assist their task, the ability of field officer need to be improved. For farmers, who in the past were neglected from the irrigation management in main level, the AMP provides more understanding on the wider perspective of irrigation management beyond the tertiary level. The AMP also provides tool for farmers to participate in the irrigation operation and maintenance. It also becomes instrument of negotiation from farmers to the government on the priority of maintenance and rehabilitation works as well as their budget sharing.

In accordance to the polycentric theory, a single authority cannot make the decision-making in water resource development and management, including irrigation. The AMP provides the tools for stakeholders to take part in irrigation management decision-making. To increase the effectiveness of this function, the institution implementing AMP and procedure of stakeholders' participation should be better prepared.

IV. CONCLUSION AND RECOMMENDATION

The Asset Management Plan for irrigation infrastructure has been developed to provide tools for better irrigation management to achieve good irrigation governance. It presents the instrument for better maintenance and rehabilitation plan as well as for negotiation among stakeholders of irrigation management.

The province level management responds the AMP implementation positively because it becomes among tools to reach more transparent and accountable irrigation management. The lower level management and farmers are also optimistic about the AMP because it helps them in their maintenance planning. However, the regency management shows pessimistic responds because of the difficulty in providing O&M irrigation budget.

In the future, it is necessary to prepare institution of the AMP implementation so it performs better as planning tool. The AMP implementation should also be in line with the adequate O&M irrigation budget to achieve better irrigation performance and furthermore sustainable irrigation system.

REFERENCES

1. Adelina, Astri, 1996, *Perencanaan Manajemen Aset Irigasi*, Thesis, Gadjah Mada University, Yogyakarta
2. Arif, Sigit S., E.Subekti dan J. Kurniawan. 2001, *Konsepsi tentang perencanaan manajemen aset dan audit teknis manaqjemen irigasi dalam kerangka pembaharuan kebijakan pengelolaan Irigasi (PKPI) : Sebuah pengalaman dari daerah istimewa Yogyakarta*. Unpublished paper.
3. Davies, Alan, 1993, *An Asset Management Program for Irrigation Agencies in Indonesia*, Disertation, University of Southampton, England.
4. FTP-UGM, 2000, *Pemberdayaan Pengelolaan Irigasi untuk Peningkatan Pelayanan Irigasi*, final report, Gadjah Mada University, Yogyakarta.
5. FTP-UGM, 2001, *Perencanaan Aset Manajemen untuk Operasi dan Pemeliharaan Irigasi*, final report, Gadjah Mada University, Yogyakarta.

6. FTP-UGM, 2005, *Monitoring dan Evaluasi Pendampingan PMA di Propinsi DIY*, final report, Gadjah Mada University, Yogyakarta.
7. Government Regulation No. 77/2001 on Irrigation Management.
8. Government Regulation Draft on Irrigation Management.
9. IIS-ODA, 1995, *Asset Management Procedures for Irrigation Schemes*, Institute of Irrigation Studies, University of Southampton.
10. Law No. 7/2001 on Water Resources.
11. Welch, James W., 1995, *Asset Management Procedures for Irrigation Infrastructure*, Disertation, University of Southampton, England.

POTENTIALS AND OBSTACLES ON IRRIGATION MANAGEMENT TRANSFER (A CASE STUDY OF FOUR IRRIGATION NETWORKS IN IRAN)

Nader Heydari[1], Alireza Mamanpoush, Mohammad Ali Shahrokhnia, Mohammad Khoramian, Mohammad Karimi[2]

ABSTRACT

Different studies have been shown that despite relative success in improving irrigation performance, none of these activities were successful in their goals and still there is "performance deficit" in irrigation networks. Studies indicated that the performance deficit is due to an imbalance between the roles of government agencies and irrigators in all levels of irrigation development including design, operation and maintenance, planning and decision making.

Irrigation management transfer (IMT) and turnover of the management and authority of public irrigation networks from government to water users associations or other entities is the major trend which is occurring in the context of irrigation management in most of the countries including I.R. of Iran.

The objective of this study was to evaluate the current situation of the four irrigation networks of Iran from view-points of the share of government and water users in decision making and irrigation management. The study dealt with the potentials and obstacles for IMT and view-points of the government and water user entities in this regard. Some marginal information regarding the role of existing institution or future established association on water management and water productivity, and farmers' responses to water scarcity during drought was also obtained.

A comprehensive questionnaire was prepared. The questions referred different target groups including farmers, water users, government staff, and the networks managers. The designed questions attempted to receive the motivation and limitations on IMT and view points of the water users and network staffs on water management issues, and their desire expectation from the changes and their anticipation form the future.

The selected networks were Droodzan, Esfahan, Dez, and Ghazvin irrigation projects. In the selection it was tried the selected networks to have all the parameters and factors regarding water management and allocation issues.

1- Assistant Prof., Ir. and Drain. Dep., Agr. Eng. Res. Ins. (AERI), P.O. Box: 31585-845, Karaj, Iran., Fax: +98-261-2706277, Email: nrheydari@yahoo.com

2- Research experts of AERI division, Agr. Res. Centers of Esfahan, Fars, Khuzestan (Dezful), and Ghazvin provinces respectively.

Based on results the potentials and tendency for IMT varies in the different irrigation networks. There is motivation for IMT potentially, but in most cases there are serious hindering factors or obstacles that affected this motivation, among them we can nominate lack of enough mutual confidence between farmers and the network management, lack of enough and or proper laws and regulations, organizations and institutional arrangements, support, and follow ups.

In most case the main motivation for IMT from farmers is equity in water allocation. However, the motivation from networks management (local government) is not clear or well defined and general objectives are stated for the motivation.

The necessity for rehabilitation and renewal of the system prior to implementation of IMT is mentioned in all cases as important condition for the successful implementation of the program.

In this paper the view points of the farmers and the government entities regarding IMT process is provided and the potentials and obstacles for this process is provided and discussed.

INTRODUCTION

By the definition "Irrigation Management Transfer" (IMT) is the turnover of responsibility and authority for irrigation management from the government to farmer groups or other non- governmental entities. It generally involves the contraction of the role of the state and the expansion of the role of private sector in irrigation management (Abernethy, 1997).

IMT is becoming a general policy for the management of irrigation sector in most countries, especially in developing countries recently. Indeed this process is not so recent. It started in some countries, e.g., USA, France, Colombia, and Taiwan, many years ago, (Vermillion, 1997). In Asia, the Philippines is one of the earlier developing countries to begin the process of management transfer.

IMT can be considered as consequences of certain global trends, which include market economics, privatization, decentralization of authority from central government, and empowerment of local communities in irrigation sector.

After the construction era and followed by reduction in construction of new irrigation projects, one resulting implication was that for sustaining current rate of growth in agricultural outputs, the hydrologic and agricultural performance of existing irrigation systems must improve (Svendsen, 1993). So a performance-oriented concern came into effect in Government officials attitudes. The activities such as on-farm development, rehabilitation and modernization of irrigation projects, and training programs of the staff are some examples of those efforts. However, the studies have been shown that despite relative success in improving irrigation performance, none of these activities were really successful in their goals and still there is "performance deficit" in the irrigation systems.

Many studies in the 1970's and early 1980's indicated that the performance deficit in newly constructed irrigation systems was due to an imbalance between the roles of government agencies and irrigators in all levels of irrigation development including design, operation and maintenance, and planning and decision making. This fact leads to initiation of IMT process.

IMT and most of the changes that are proceeding now, mostly originates from governments. Because of shortage of financial resources, governments have found that it is difficult to manage and operate irrigation systems based on the old modes of public organizations management especially following rapid expansion of irrigated areas.

There are some evidences (Vermillion, 1997) which IMT programs have not been completely successful in implementation phase or had negative impacts both on governments or farmers after turnover process. As Vermillion, 1995 (Meinzen-Dick, 1997) stated, management transfer programs which do not ensure that necessary conditions for effective management are met, will create “false or failures”. The results should be that after a few years system will deteriorate and state agencies will seek to take over management once more (Meinzen-Dick, 1997). Therefore, IMT programs need some implications, policies, conditions, processes, and enabling environment.

These programs also can be implemented in various levels. Levels of disengagement programs vary by the country and local conditions

IMT or transfer of irrigation systems management is the most apparent trend which is occurring in the world, especially in the developing countries. This process has also started in Iran some years ago and is accelerated recently.

The main objective of this research was to study the process of IMT in the irrigation networks of Iran. The specific objectives were:

- To study the potentials, incentives, and motivations for the IMT both among water users and government officials in the selected irrigation networks.
- To study the limitations, problems, and obstacles for the IMT in the selected irrigation networks.
- Overall evaluation and perception from IMT and other issues of water management relevant to the selected networks.

MATERIALS AND METHODS

Four irrigation networks were selected for the purpose of the research. The selected irrigation networks were: Droodzan, Esfahan, Dez, and Ghazvin irrigation projects located in the Fars, Esfahan, Khuzestan, and Ghazvin provinces respectively.

The criteria for selection of the irrigation networks were all the networks to be typical and have all the problems relevant to water management and irrigation performance, O&M, and water limitations and scarcity.

It was attempted to review all the literature and information of the selected networks to make a familiarity with the problems relevant to the water management and irrigation network operation and performance.

A comprehensive questionnaire was prepared and filled through interview with the farmers, water users; irrigation networks expert staffs and the networks management authorities.

In the followings the specification of the selected irrigation networks and the basic contents of research questionnaire are provided and explained.

SPECIFICATIONS OF THE IRRIGATION NETWORKS

Droodzan irrigation network

The Droodzan irrigation network (DZIN) is located in the Marvdasht region in Fars province (Fig. 1). The DZIN is located in between 45^{o} 51′ to 53^{o} 26′ E longitude and 20 ^{o} 29′ to 30 ^{o} 14′ N latitude. The gross and net cropping areas of the networks are 65460 and 55640 ha respectively.

The cropping pattern in the network includes Wheat, Barely, Millet, Canola, Paddy, Maize, and summer crops (melons, tomato, etc.).

The source of water is Droodzan reservoir on Kour River with a capacity of 993 MCM. In the network there are totally 150 Km main canals, 44 Km secondary canals, and 517 Km tertiary and quaternary canals (Fig. 2).

Figure 1. Location of DZIN

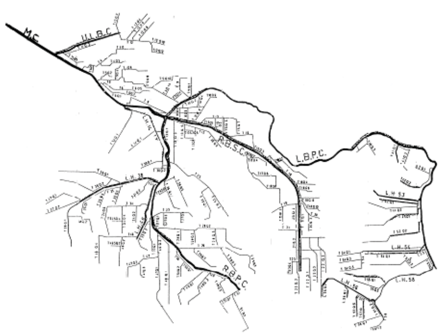


Figure 2. The canal network of DZIN

Esfahan irrigation network

The main source of irrigation water for the Esfahan Irrigation Network (EIN) is the Zayandeh Rud (ZR) river. The ZR river has been the lifeblood of Central Iran for centuries, focused around the ancient city of Esfahan. The Zayandeh-Rud Basin (ZRB) is experiencing the water stress. It has been the situation for the past 50 years. Expansion of the irrigated area through major investments in modern irrigation systems, the establishment of large scale industries which require significant volumes of water and the continuing rapid growth of Esfahan city has all depended on the fragile water resources of the ZRB.

Since 1950 strategies have been taken to increase natural water potentials, both through trans-basin diversions and reservoir construction. But by 2000 it was clear that demand has continued to grow faster than the possible water resources development. As a result there is increased pressure on both water and soil resources. Tail end areas show the greatest stress with reduced water availability, deteriorating ground water quality, increased soil salinity and declining agricultural production and little water reaches the environmentally valuable Gavkhouni swamp (Fig. 3) at the tail end of the ZR river (Salemi et al., 2000). In Fig. 3 the location of ZRB and EIN irrigation networks are provided. All new systems have conjunctive use of surface water and groundwater.

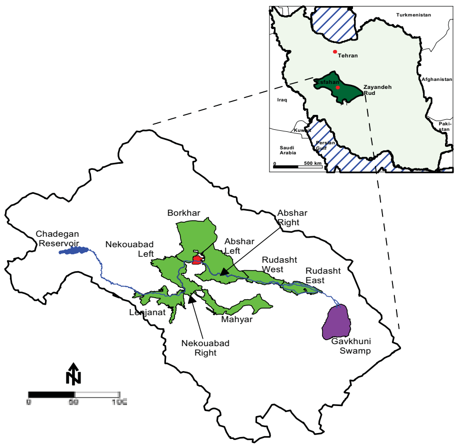


Figure 3. Zayandeh Rud basin and location of the Esfahan irrigation networks

Modern surface irrigation started with the construction of Chadegan reservoir and major diversion weirs at Nekouabad and Abshar in 1970 (Fig. 3). These four systems have provided the bulk of irrigated agriculture for the past 30 years. However, one large-scale traditional gravity system still survives, at Rudasht, the most downstream of the irrigation diversions. In the past few years there has been a large increase in the gravity irrigation network. Two large systems have been constructed at Mahyar and Borkhar, while the Rudasht network has been modernized and a new weir constructed.

Modern irrigation, either in the form of large-scale gravity irrigation systems fed by large regulating weirs or electric or diesel-powered Tubewells, accounts for almost all 90,000 ha irrigated area in the EIN. Traditional canals have been absorbed into the large-scale systems, while many Qanats have either fallen into disrepair or have been dried up by adjacent drilling of deep boreholes.

Typically there is a two-season cropping pattern in all of the irrigation systems in the Zayandeh Rud basin. Summer crops include potatoes, rice, onion, and vegetables while winter crops are dominated by wheat, barley, and sugar beet. In addition there are some annual and perennial crops, including alfalfa, orchards.

The irrigation season commences on 1 April in all years, and Chadegan reservoir releases remain more or less constant in May, June, July and August.

Dez irrigation network

The Dez basin is located between 48^{o} 10′ to 50^{o} 21′ E longitude and 31 ^{o} 34′ to 34 ^{o} 04′ N latitude in Khuzestan province in the south of Iran (Fig. 4). The total area of the basin is 21720 Km^2. The main source of water for the Dez Irrigation Network (DIN) is the Dez river. The river originates from Zagrous ranges and is regulated by the Dez Reservoir and the Dezful regulating dam. The river joins to the Karoon River and finally flows to the Persian Gulf the outlet of the basin.

Currently around 17000 farmers and four Agro-Industries are involved in the agricultural activities in the DIN.

There is plenty of water in the region and the quality of water and soil for agricultural uses is suitable. The climate of the region is temperate to warm and all agricultural crops except the crops specific for cold regions can be cultivated. The common cultivated crops in the networks are: Wheat, Barely, Maize, Pulses, Alfalfa, Sugar beet, Citrus, and Sugarcane.

The design consultant company of the DIN had proposed a cropping pattern for the 50 years life of the network (1966-2016). However there are regular fluctuations in the cropping pattern in the past years. The initial proposed cropping pattern were mostly based on production of forage crops while because of government policies, crop prices, and lack of use of proper machinery it deviate from the original and it can be said that the initial cropping pattern never executed.

Ghazvin irrigation network

Ghazvin Irrigation Network (GIN) is located in the Ghazvin province almost 100 Km west of the Capital (Tehran) (Fig. 5). The source of irrigation water is the Taleghan river, originated from the Alborz ranges in the North. The area of river basin is 748 Km^2. The average discharge of the river is around 420 MCM per year of which about 280 MCM is used in the GIN.

The common cultivated crops in the GIN are Wheat, Barely, Canola, Sugar beet, Pulses, Potato, Tomato, Maize, Alfalfa, and Orchards (Grape and Apple). The total cultivated area is 60,000 ha and the total fallow land area is 15000 ha per year.

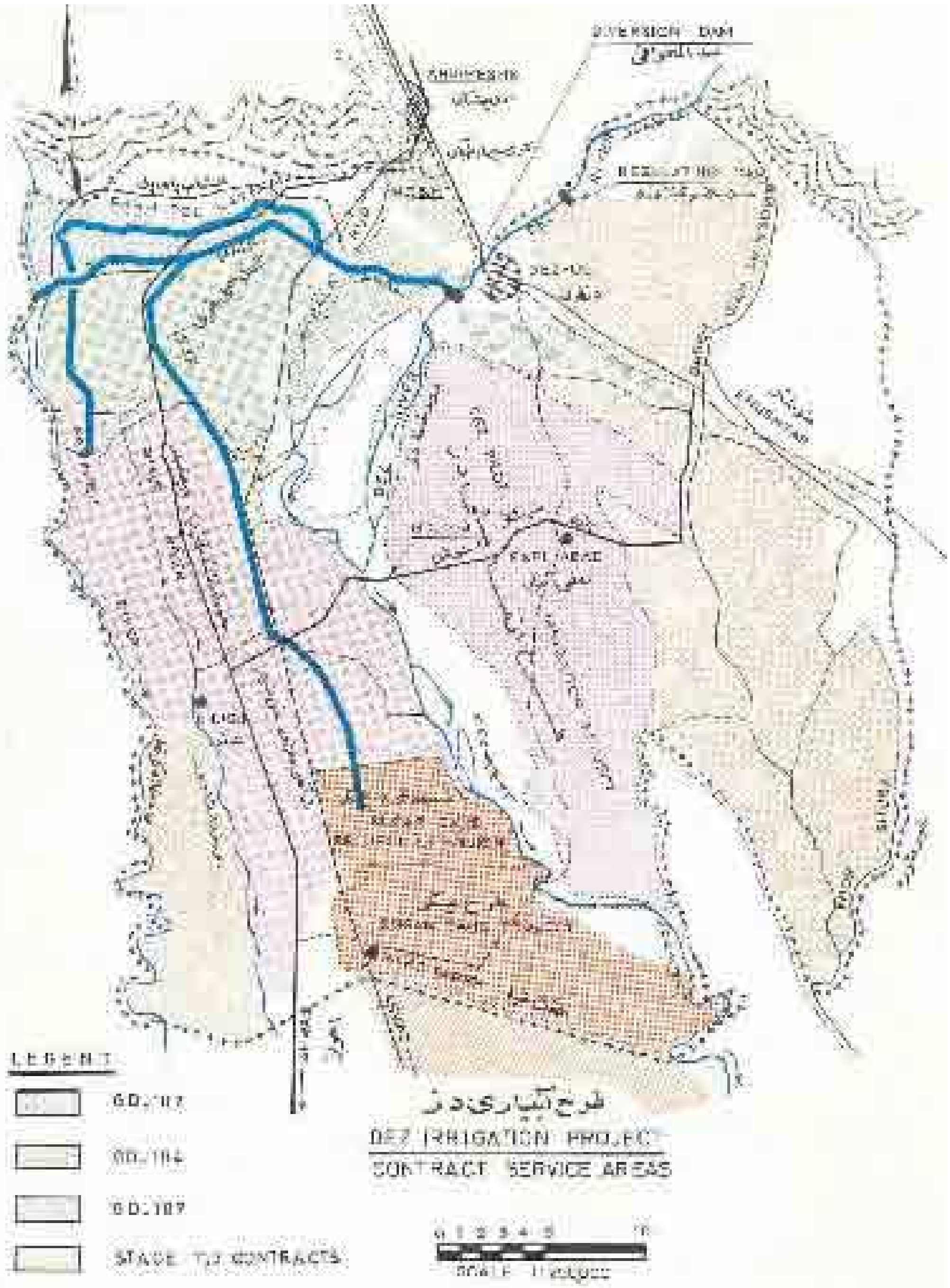


Figure 4. The Dez irrigation network

Water resources availability has been one of the major hindering factors on the economical development of the Ghazvin Plain. Following the earthquake disaster in the region in 1962 and the unique location of the region, considering the closeness to Tehran and to the transit roads to the west and north of Iran, this region was paid more attention for the development. One of the outcomes was study of 422000 of lands and crop production in these lands using regulated surface and groundwater resources. Ghazvin Development Project (GZDP) started at 1967. It comprises different water development projects which are conducted during the last three decades and it is still being completed. Following complete implementation of the GZDP the irrigated area in the Ghazvin plain will be around 220,000 ha. Currently there are 30,000 farmers in the network.

The Research Questionnaire

The questionnaire includes three types of questions including general questions, questions regarding the irrigation network, and specific questions (from the farmers and the networks staff and officials) on participation of water users and irrigation management transfer. In overall, the designed questions attempted to receive the motivation and limitations on IMT and view points of the water users and network staffs on water management issues, and their desire expectation from the changes and their anticipation form the future.

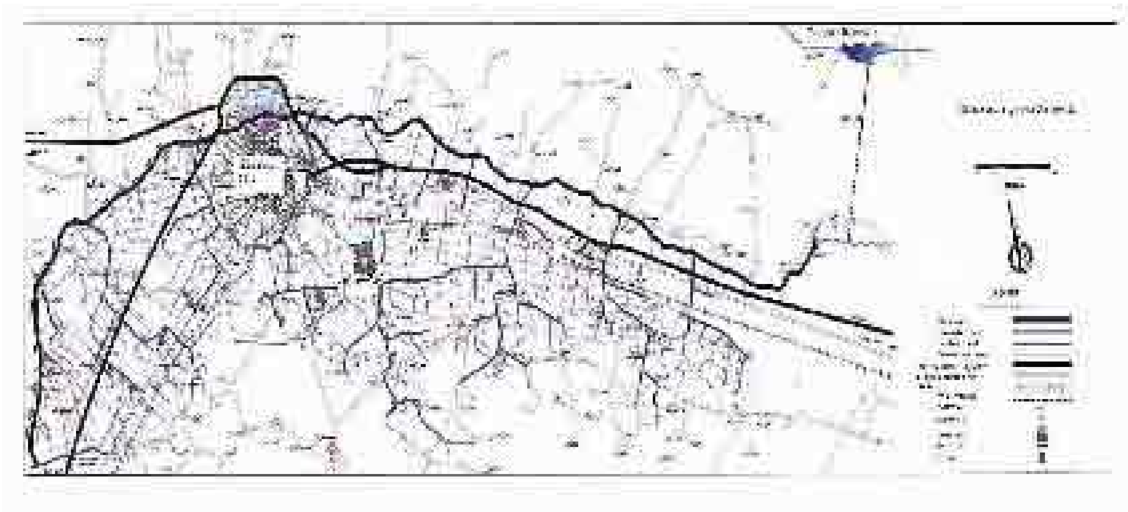


Figure 5. The Ghazvin irrigation network

Regarding IMT, the following set of conceptual questions included in the questionnaire:

- Current problems and inefficiencies in the irrigation network
- Levels of satisfaction of users from current condition of the irrigation network and the sustainability of irrigated agriculture
- Motivation, potentials, and hindering factors among water users and the irrigation network management team and staff on devolution of authorities and IMT
- Desired levels of disengagement and IMT
- Required conditions and enabling environment for IMT
- The expectations from IMT regarding improvement of water allocation and equity
- Rehabilitation of the network prior to IMT and Government support following IMT program

- Water users participation during drought and water scarcity conditions
- The water users anticipation, expectations and predictions for the future of agriculture and water management in the irrigation network

RESULTS AND DISCUSSIONS

In the following, the results of questionnaire on IMT issue of the selected irrigation projects are provided. The results are summary of answers to the direct and indirect questions set in the research questionnaire for evaluation and understanding of the current situation of the irrigation projects, their water management problems, and the motivations and limitations on IMT process in these networks.

Droodzan irrigation network

The history of agricultural and irrigation activities in the Droodzan region goes to ancient times of Achaemenian dynasty. The DZIN was completed in 1972. Its command area was 42000 ha and laterp it increased to 56000 ha. It is operated by the water board authorities of the Fars Province.

Based on the government policies and approval of the farmers, the crop type and cropping areas are determined, and water deliveries to the farmers are based on individual contracts. There is a continuous flow of water in the network and the water masters deliver water to the farmers at the downstream of tertiary canals.

One of the main limitations of the agricultural production in the DZIN is water logging. There are totally 700 Km drainage canals in the networks that need proper planning, operation and maintenance. There is no accurate and controlled supervision on water intakes from the gates.

Little on-farm development activities has been done in the network and little training and capacity buildings activities has been done both for network staffs and the farmers.

The overall irrigation efficiency of the network is estimated to be 44%. In the network, the farmers use groundwater in water scarcity and drought condition for supplemental irrigation to save their production. The water price is 3% of the total crop production in terms of monetary. However, the water pricing policy had little effect on water savings in this network.

In overall, the network is facing with different problems, affecting its performance. These problems include shortage of specialized human resources for new irrigation and water management methods, financial inefficiencies, shortage of O&M activities, inequity on water allocation and crops yield losses during drought years and water scarcity, lack of proper water measuring devices, and socio-cultural problems of the water users and social stresses during dry years in the network.

During water scarcity and drought years cultivated crops are reduced and water rationalization policies are imposed. In this situation social stresses and conflicts and water violations are increased. Based on network staffs perceptions, in this condition there is not much cooperation between farmers and the system and even among farmers themselves. This is partly due to the mismanagement of the network.

At the present condition, there is not much motivation for IMT especially from the farmer side. It is mainly due to lack of enough confidence and reliability of the farmers to the network management. The farmers believe the IMT but need more support from the government. Their main wish and willingness from these programs is improvement in the equity of water delivery.

The motivation for the levels of IMT is mainly to the management of the tertiary and quaternary canals. However, the farmers are also willing to have supervision on the management of secondary and main canals through their representatives.

Based on questionnaire, the conditions and enabling environment for IMT in this network is mutual confidence, cost recovery of IMT to the farmers, training and capacity buildings of the farmers and management team of the network, rehabilitation and renewal of the system prior to IMT.

It is also stated that the IMT programs need consistency. A number of Water Users Associations (WUAs) have been created but has left following management change of the network. This has led to reduction of farmer's confidence and trust in the system. Based on the irrigation network officials, currently there are 190 WUAs officially, but based on farmer's perception only three of them are active. The irrigation network management is not much satisfied with the function of these associations.

This network needs more socio-cultural activities and improvement of participatory work. They believe that current levels of water management are not sustainable and its continuation will make damages to the farmers and the system.

Esfahan Irrigation Network

In general, the primary threats to sustainable irrigated agriculture in this network are: reductions in water for agriculture because of competition from other sectors, declining water quality in both groundwater and surface water resources, and soil salinization. There other problems and limitations associated with this network are: the low knowledge levels of the farmers, lack of training on water management, extra losses in the earthen canals and damages to the lined canals, fluctuations in water discharges, and inequity in water allocation. From farmer's perception, water shortage caused by improper delivery and extra losses from the earthen canals are the main source of low irrigation efficiency. However, research studies (Akbari, et al., 2004) indicate the water productivity in the irrigation networks is relatively high and in average is around 1.4 Kg/m^3. This is mainly because of the deficit irrigation that the farmers generally practice.

The farmers use groundwater for supplemental irrigation during water shortage in critical crop stage or whenever they fill there are threats to crop yield due to water.

In the case of water scarcity or drought in the network, the farmers reduce the cultivated area and apply some innovations for more water saving. The water scarcity condition also causes some disturbance in farmers communities and creates some conflicts with the network management team.

The farmers are willing for IMT and the ground is ready, but it needs government support and capacity building. Most of the farmers believe that with IMT the equity in water allocation will improve and their crop yields will increased.

They stated that rehabilitation and renewal of the irrigation network is one of the primary conditions for IMT implementation. They also want their involvement and participation in the process of IMT to be more legalized and documented.

Their request for improvements in the system are on-farm development activities (canal lining, pressurized irrigation, etc.), and trainings on irrigation and water management.

They believe that the future of irrigation and sustainability of water management in this network depends on behavior and support of government. There are some doubts and some hopes to this future.

Dez Irrigation Network

Of the major problems of the DIN, is the low irrigation efficiency (around 31%). Some reasons for the low irrigation efficiency are lack of completion of the tertiary and quaternary canals in parallel to the main and secondary canals, small farms sizes, plenty of water and irrigation in the day times only, and lack of proper training and capacity building on new methods of irrigation management.

Water price for the agro-industries available in this network is volumetric basis. It is about 2% of Rials/m^3 (0.0002 US Cent/m^3). The water price for the other farmers and the orchards depends on crop type and is based on cultivated area. For example the water price for Wheat and Tomato are 262000 Rials/ha (28 US$/ha) and 887000 Rials /ha (96 USS$/ha) respectively. Water pricing is not based on farmers view points and due to lack of volumetric allocation, water pricing has not much effect on water savings.

History of farmer's participation in water allocation in the Dez area returns to ancient times. Prior to construction of DIN the farmers diverted the Dez river to their land through digging of six Qanats and 14 irrigation canals. Currently there are 29 agricultural cooperatives of which 21 cooperatives are active.

The Water Company (under Water Deputy of Ministry of Energy) is not willing to manage tertiary canals, and supposes it is duty of the Agrultural Organization (Ministry of Jihad-e Agriculture). Therefore, currently there is no efficient management of tertiary and quaternary networks from the company side. This company just handles the affairs relevant to the secondary and main canals in the DIN.

IMT is not a seriously followed process in this network even in the levels of the tertiary and quaternary canals. Based on DIN management staff there are different obstacles in IMT in this work among them the following are the most important:

- Distribution of agricultural lands to small sizes
- Low interest among farmers to participatory work and lack of enough cooperation in water rationalization
- Lack of implementation of the proposed cropping pattern by the network consultant engineers

- Lack of required coordination among the authorized organizations for the management of land (Ministry of Jihad-e Agriculture) and water (Ministry of Energy) and lack of execution of establishment of WUAs acts and bylaws
- No clarity on the ownership of lands in some parts of the network
- Lack of enough confidence to proposed plans by the responsible authorities in the networks and their negative background on the former establishment of cooperative programs
- Lack of programs and plans on justification, concepts, clarity on the concept and objectives of IMT, and the roles of WUA for the farmers

It is suggested that for the initiation of the IMT programs firstly they start in the small scale and pilot levels, e.g., turnover of the small size pumping stations or the command area under some gates in the different parts of the network.

In overall, the irrigation network management staff recommend that IMT in the DIN to be in the levels of tertiary and quaternary canals.

Overall, the following conditions have been proposed for a successful IMT in this irrigation network:

- Participation of the farmers in all stages of design, execution, operation, and maintenance
- IMT firstly be implemented in the pilot level
- The DIN be managed through a steering council and the representatives of the farmers be members of this council
- IMT be implemented in different stages
- Clarity in the roles, laws, and responsibilities and authorities
- Execution of training and capacity buildings programs for the farmers and the network staff in order to increase their culture of responsibility and participation
- Rehabilitation and renewal of the system prior to IMT.

Ghazvin Irrigation Network

The problems associated with the water management in the GIN are: The general problems and in efficiencies during more than 30 years implementation of the GZDP, lack of proper O&M activities and early deterioration of irrigation facilities, illegal water intakes, increase in illegal well drillings and expansion of the legal wells water withdrawn capacity leading to over exploitation of ground waters, and the risk and security problems both for the network and human health due to expansion of settlement and communities into the irrigation networks areas.

There is increasing demand and competition for water resources due to expansion of urban and industrial sectors. This competition also exists within agricultural sector in the network and in the region due to increase in income and economical profitability of agricultural activities in the region.

During water scarcity and drought, the pressure on groundwater resources increases and most of the farmers request for getting license for drilling of new wells in their lands. In this situation the network management just forces on reduction of the cultivated area and there are no other implications and risk management.

The main motivation for IMT among farmers is equity in water distribution. They are also interested in the program to be in low levels and then implemented in higher levels if they receive government support.

For successful implementation of IMT they believe to the following pre-conditions:

- Rehabilitation and renewal of the network (as the first priority)
- Reliable supply of water
- Confidence and reliance of the farmer to the program
- Support from relevant government organizations e.g., Jihad-e Agriculture, Water organizations, and Military services for conflict resolution
- Training and cultural capacity buildings

However, the farmers are optimistic to future and agricultural sustainability and profitability in the region.

The GIN is one of the pioneer irrigation networks in IMT programs in Iran. The program has been implemented in this network from 2002. The main objective of the program is conservation of the system and its optimum operation. This plan started using the local and regional capacities and implemented in three phases during three years. At the end of year 2005, the final phase of program was completed and the administrative, financial, and operational authorities of the system were devolved to the WUAs.

The following functions are conducted by the representatives of the WUAs without involvement of Government:

- Record, distribution, and allocation of water to the users;
- Canal sediment function, maintenance, and rehabilitation of the networks facilities and structures;
- Volumetric allocation of water to the managers of the WUAs in the main canals intakes;
- Replacement of the frequent and repeated references of 3000 farmers in the network with only 10 responsible persons from the established WUAs

Deficiencies and weak points of the IMT in the GIN are mentioned as the following:

- Uncertainties in water supply;
- Lack of enough social studies for determination of proper structure of operation of the system with the participation of water users;
- Deficiencies in laws and regulations;

- Deterioration and break of the network and inefficiencies in water allocation and distribution;
- Insufficient comprehensive training and capacity building programs for water users;
- Lack of installation of proper water measuring instruments for volumetric allocation of water in the tertiary and quaternary networks;
- Lack of government support from the established WUAs;
- No clarity in financial processes and the method of dealing with the revenues and costs;
- Ambiguities in administrative structural relation of the WUAs with governmental organizations.

SUMMARY AND CONCLUSIONS

Recent trends that are occurring in the context of irrigation system' management, mostly are consequences of trends of governments global appeal in implementation of disengagement and privatization programs such as market economy and devolution of authority from central government to the state level.

Irrigation management transfer or devolution of irrigation system management to the farmers groups or other entities is the most apparent trend which is occurring in the world, especially in developing countries, following reduction in constructive policies of the governments.

Levels of disengagement programs vary by the country and local conditions. But in general it is mostly related to the economic levels of the countries and their socio-economic growth.

Transfer programs need some preconditions and enabling environment to be successful and to have positive impacts on irrigation system performance and to make irrigation agency financially autonomous. Among these, government subsidies policies, public agency staff jobs security after turnover of management, consideration of existing institutions, and farmer's participation in all aspects of design, rehabilitation and renewal of the system, should receive more attention. The turnover process should be implemented gradually, and it will be more successful if system rehabilitation could be done prior to its implementation.

The IMT process also has started in Iran as consequence of global trends and national needs and necessities. This research attempted to survey and study the motivations and incentives for implementation of such programs among both farmers and government officials. It was also tried to receive the viewpoints on existing situation, problems and obstacles, and comments for improvements and successful implementation of this program in four selected irrigation networks of Iran namely Droodzan, Esfahan, Dez, Ghazvin irrigation networks, denoted as DZIN, EIN, DIN, and GIN respectfully.

In the DZIN it can be concluded that equity and reliable water supply, especially during water scarcity and drought, are major concerns and motivation for IMT. There are not much confidence and reliability to the system management. Therefore, the ground for

IMT is not much ready. However, both the farmers and network management believe that if such programs are implemented it should be only limited to the tertiary and quaternary levels. The farmers also need support of government for the IMT and for improving their knowledge and awareness through implementation of training and capacity building programs.

In the EIN the motivation for IMT is higher. However the farmers request is the turnover of authorities and responsibilities to be more legalized and documented. They also request for more support from government and rehabilitation and renewal of the system prior to IMT implementation. There are some doubts and worries about future of irrigation and sustainability of agriculture in the region and believe that the government can play a key role on preserving agricultural sustainability.

In the DIN there are not much support or serious actions for IMT. The farmers are not much oriented or aware of the IMT objectives and have not much clear or positive background for such programs due to their bad background on establishment of agricultural cooperatives. However the farmers and government officials believe that the IMT should be implemented in low levels. It should be started gradually and in the first step in pilot scale. The deterioration of the network and lack of enough financial resources for its renewal is also a source of low incentive for IMT in this network.

In the GIN, the IMT has implemented partially. The results are somehow positive. However, there are inefficiencies including uncertainties in water supply, gaps in laws and roles, no establishment of organizational structure and linkage with the governmental organizations.

From the results of the four studied irrigation networks, it can be concluded that there is motivation for IMT potentially, but in most cases there are serious hindering factors or obstacles that affected this motivation among them we can nominate lack of enough mutual confidence between farmers and the network management, lack of enough and or proper laws and regulations, organizations and institutional arrangements, support, and follow-ups. In most cases, the main motivation for IMT from farmers is equity in water allocation. However, the motivation from networks management (local government) is not clear or well defined and general objectives are stated for the motivation.

The necessity for rehabilitation and renewal of the system prior to the implementation of IMT is mentioned in all cases as important condition for the successful implementation of the program.

Support of government and creation of proper linkages with the turnover systems are also mentioned as requirements.

In most of the networks there is no coordinated or risk management for facing with the conditions during water scarcity and drought.

There is also a general request and need on training and capacity building for the users and management team of the networks on empowerment of participatory activities and understanding the concept and objectives of IMT.

REFERENCES

1. Abernethy, C. (1997). Irrigation system management. Lecture notes of the course: Irrigation system management, WEM Program, School of Civil Engineering, AIT University, Bangkok, Thailand.

2. Akbari, M. (2004). Combining of remote sensing, field data and SWAP simulation model for improving field irrigation management. PhD Dissertation, Tarbiat Modarres University, Tehran, Iran (in Persian).

3. Meinzen-Dick, R. (1997). Farmer participation in irrigation (20 years of experience and lessons for the future). Irrigation and Drainage Systems, 11: 103-118.

4. Salemi, H.R., Mamanpoush A., Miranzadeh, M., Akbari, M., Torabi, M, Toomanian, N., Murray-Rust, H., Droogers, P., Sally, H., Gieske, A. (2000). Water management for sustainable irrigated agriculture in the Zayandeh-Rud basin, Esfahan province, Iran. Iran-IWMI Collaborative Research Project, Research Paper no. 1.

5. Svendsen, M. (1993). Irrigation financing policy and institutional change in the Philippines. Proceedings of the 15th Congress on Irrigation and Drainage (Water management in the next century), The Hague, The Netherlands, ICID Transactions, Vol. 1-F, Question 45, R30-R49: 463-476.

6. Vermillion, D.L., (1997). Impacts of irrigation management transfer (A review of evidence). Research report no. 11, International Water management Institute (IWMI), Colombo, Sri Lanka.

PRECONDITIONS FOR THE POPULARIZATION OF PIM IN THE LOWER YELLOW RIVER IRRIGATION AREA

Cheng xianguo[1], Jiang binzhou[1], Fengxing[2], Jin Ming[1]

ABSTRACT

The Lower Yellow River Irrigation Area (LYRIA) in the Yellow River plain downstream is the largest connected irrigation area by 98 separate irrigation districts. The total irrigation area is about 2147.33 thousand hm^2. Differing from the popularization of PIM in many other countries and many other parts of China, PIM can hardly be found in the LYRIA. This paper analyzed the reasons of difficulty for wide spread of PIM in LYRIA and put forward the preconditions for the popularization of PIM in LYRIA. It mainly consists of the following aspects: Firstly, improving infrastructure construction and consolidating the hardware supportive base; Secondly, Reforming the existing management system through market mechanism; Thirdly, Well establishing Water Rights Markets to promote water price formation mechanism and adopt end water price; Fourthly, Managing the surface and ground water in a holistic way; Fifthly, Enhancing capacity building and improving water resources management capability; Finally, Improving the policies, laws and regulations system and promoting association regulations construction, etc.

1- BRIEF INTRODUCTION OF YELLOW RIVER DOWNSTREAM IRRIGATION AREA

The Lower Yellow River Irrigation Area (LYRIA) refers to the irrigated area where the water sources for irrigation comes from mainstream of the Yellow River ranging from Tiao HuYu to the estuary. This irrigation area distributes in a strip-like way along the two banks of the Yellow River. LYRIA covers three river basins (including the Yellow River, Huaihe River and Haihe River), including 86 counties in 17 cities of Henan and

1- Cheng Xianguo, male, born in 1965, senior engineer, major in water resources management and water saving research. Yellow River Institute of Hydraulic Research, YRCC 453003;

2- Upper and Middle Yellow River Bureau, YRCC

Shandong provinces. The beneficiaries total to 52.71 million, with population density of 573 persons per square kilometer, among which 43.72 million are farmers, accounting for 82.9 percent of the total.

LYRIA is China's important base for food, cotton and oil seed crops, which plays a significant role in guaranteeing the stable and high yields for the two provinces during the last several decades. The main crops include wheat, maize, rice and cotton, etc. According to the 'Yearly Water Resources Statistics Book' of the two provinces, the annual irrigation water quantity is 15.97 b m^3. The percentages from the Yellow River, local surface water and ground water account for 51%, 10% and 39% of the total respectively. The usage of water is mainly for agriculture, industry and township domestic consumption, agriculture use accounting for 92% while industry and domestic accounting for 5% and 3% respectively.

Heretofore, 137 irrigation projects have been built in the downstream of the Yellow River including 97 sluices, 16 siphons and 24 pump stations. The total diverted flow capacity is 4250m^3/s. There are 98 irrigated regions with each area above 10 thousand Mu (1 Mu equals to 667 m^2), including 11 larger-scale regions with each area above 1 million Mu, 26 large-scale irrigation regions with area between 0.3 and 1 million Mu, 61 middle-sized irrigation regions with area below 0.3 million Mu. The farmlands in the area totals to 3.891million ha with designed irrigated area 3.579 million ha, actual irrigated area 2.147 million ha. After years development, three main types of irrigation ways have been formed like gravity irrigation, pump irrigation l and sources-replenishment irrigation.

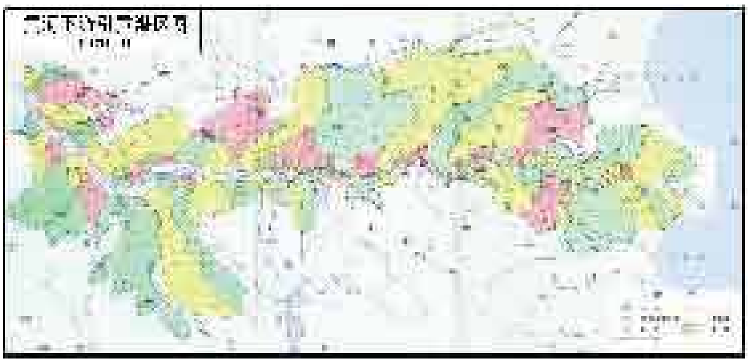


Fig.1 Distribution of LYRIA

2- THE STATUS OF PARTICIPATORY IRRIGATION MANAGEMENT IN LYRIA

Participatory Irrigation Management was introduced into China in the nineties with World Bank funded projects, and was piloted in Tiesan irrigation region of Hunan province and Zhanghe irrigation region of Hubei province respectively. Based on the World Bank Project principles, some preliminary outcomes and experiences have been achieved in China through establishment of economically independent irrigation and

.

drainage zones, and promoting farmers participation in the irrigation management

Comparing with rapid development in other regions, participatory irrigation management is in a slow development stage in the downstream of the Yellow River. According to data, only not more than 200 water user associations has been set up before 2005 in LYRIA, which mostly don't function well as they should.

3 CAUSES FOR DIFFICULTIES IN EXTENSIVE REPLICATION AND SCALING UP OF PARTICIPATORY IRRIGATION MANAGEMENT

3.1. INSUFFICIENT HARDWARE SUPPORT

Most of the irrigation projects in the lower Yellow River were constructed in the fifties or sixties with low design standard and quality. There are only main transport canals and structures in many irrigation regions without tertiary canals and secondary canals. The canal systems are unlined mostly and the control structures are brick-made. After several decades' operation, the canals and structures become aged and badly damaged, with high seepage and low irrigation efficiency. According to statistics, the irrigation efficiency decreases as low as 0.4 to 0.5, the aged irrigation structures account for 29% to 42% of the total and the aged canals account for 38% to 70% of the total. Since 1998, although the State invested fund to restructure the large-sized irrigation system for water saving and counterpart structures, most part of the irrigation infrastructures are still lag behind.

In irrigation water monitoring, water amount from village to farmers has not been measured although water from county to towns has been done. Because of the shortage of water monitoring, water fee was calculated depending on cultivated land area or the numbers of every family. Therefore, farmers manage to use water as more as possible and cause serious problems of wasting water.

3.2. LAGGARD MINDSET AND INSUFFICIENT SUPPORT FROM THE GOVERNMENT

Since the household responsibility system has been adopted for a long time, the independent farming model has taken root in farmers' mind, plus laggard mindsets and low knowledge, resulting in lacking cooperative awareness, incentives and initiatives to protect legitimate rights and participate public affairs. Local governments' too-much and excessive interference discounts the extension of PIM. The fact that the reform of water use system involves so many stakeholders contributes to the difficulties in applying PIM. For instance, village and township levied the water fee. It is prohibited to embezzle the fund and increase the fee by excuse. But in reality, it always happens due to the fact that, to some extent, it eases the financial tension of townships and villages.

3.3. CONSTRAINS FROM ADMINISTRATIVE SYSTEM AND OPERATION SYSTEM

The irrigation administration in LYRIA is conducted separately within each district. There are four levels in terms of the irrigation administration system, the top level is provincial water administration department, following up is the county (city) water administration department, township water administration sectors constitutes the third level, and the village water administration commission ranks the forth level. Such a system results in organizations' overstaffed, low efficiency and functionally duplicating. Due to the accountability, obligation and rights are not clearly defined for each level the water administration organizations become loose with a mess management. The irrigation management model formed in the planned economic context does not fit the market economic requirement, which make it tough to solve such kinds of problems as project aging, insufficient investments, uncertainty of responsibility in the regards of water diversion and transportation and management, laggard maintenance, difficulties in levying water fee and misuse of water fee, etc.

3.4 THE LOW WATER RESOURCES AVAILABILITY AND NO HOLISTIC WATER RESOURCES MANAGEMENT

The Yellow River runoff is the main source for the irrigation in LYRIA, the fluctuation of Yellow River runoff affects water availability of Yellow River downstream directly and hence water supply situation to the LYRIA. The discharge through the section of Hua yuankou is gauged to represent the actual availability of flow in the downstream of the Yellow River.

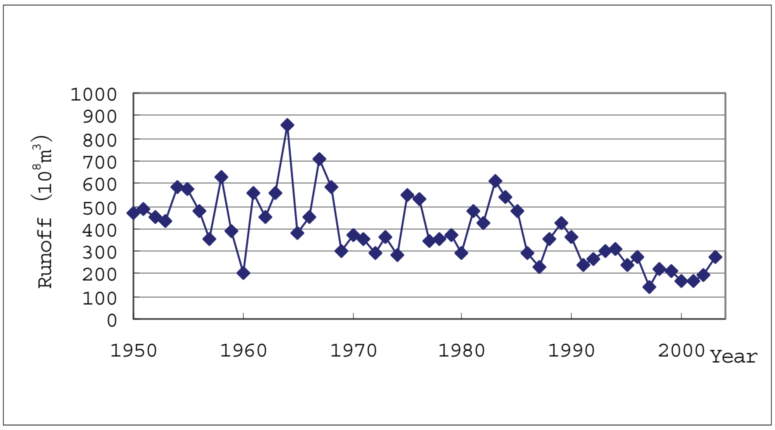


Fig. 2 The measured yearly runoff of Huayuankou Hydrology station

It shows in the Graph 2 that the water flow in the lower reach of the Yellow River has been decreasing since fifties, resulting in ever-lowering of the irrigation water assurance rate. The situation was more directly reflected by the river' drying up. The first incident of drying up happened in 1972 in the downstream. Thanks to decrease of rainfall and increase of industry water consumption since eighties, the drying up occurs almost every year when it enters nineties, especially, the whole reach within the territory of Shandong province is dry in 1981,1995,1997. There are 13 drying-up incidents in the section Lijin Hydrological Station in 1997, when the total days with no water in the river bed amounted to 226 days, and there was not water flow into the sea in 330 days. The total river length of dry riverbed is up to 704 km, accounting for 90% of the total length of the downstream.

The ground water resources accounts for one-third strong of the irrigation water resources, which plays active role in guaranteeing the water supply to irrigation area. But in the context that the withdrawal of ground water is in disorder state, there is no possibility to manage the water resources of the Yellow River flow, local surface water and ground water in a holistic way, which triggers setbacks for farmers to participate in the irrigation management.

4. THE PREREQUISITES FOR WIDE SPREAD OF PIM

4.1. IMPROVING INFRASTRUCTURE CONSTRUCTION AND CONSOLIDATING THE HARDWARE SUPPORTIVE BASE

Established projects and corresponding counterpart facilities such as measurement meters or gauge are necessary to facilitate PIM. Hence, for the end to create sound climate to implement and extend PIM, it is required to map out preferential policies to diversify fund source and intensify investment on the irrigation projects, aiming at boosting the strength in irrigation area extension and water volume measurement facilities construction. Water user association should be established based on hydrological unit rather than administrative unit to facilitate water management. As for trans-boundary canal system, it is advised to set up controlling structures and water gauge along the boundary so as to easily control water supply and measure discharge.

4.2. REFORMING THE EXISTING MANAGEMENT SYSTEM THROUGH MARKET MECHANISM

Such phenomenon as insufficient cost recovery, lack of maintenance, infrastructure aging, ever-lowering service quality, agriculture produce reduction, farmers' dissatisfaction and reluctant to pay water bill widely exist, which, in reality, develop a vicious circle that cannot be addressed in the context the government directly involves in irrigation management The existing irrigation management system and operation mechanism can not fit the market economic requirement. It is inevitable to establish a wholly new irrigation management system and operation mechanism for the sake to address the situation featuring excessive administrative hierarchy and governments interventions, difficult in levying water fee.

.

The popular model of irrigation management decentralization to farmers is a good practice. It aims at mitigating government financial burden, lifting productivity and improving irrigation efficacy through making improved irrigation management more closely associating with farmers' real needs. Farmers should enjoy some administrative rights and authority and participate in the irrigation management and decision-making, which will have impact on their future development and livelihood.

The system reform, or institution reform, should go beyond the traditional concept that reform mainly focus on staff training and personnel staffing, rather, it should also cover irrigation management structure reform and framework arrangement. Institutionally, some soft aspects should be paid the same attention as that of the hardware of project, since the institution and its framework determine whether the mammoth investment on the projects could yields due profits.

4.3 WELL ESTABLISHING WATER RIGHTS MARKETS TO PROMOTE WATER PRICE FORMATION MECHANISM AND ADOPT END WATER PRICE

Water is basis for the existing and development of the LYRIA. The water supply should transfer from the need-oriented model to availability-oriented in the perspective of optimization of water resources allocation. The theory of water rights and water market should cover the whole process of irrigation management activities. More serious efforts should be paid to the initial water-use rights distribution, water consumption index, water consumption quota and water price formation mechanism. By introducing water market mechanism spur water users scientifically consume water and water saving.

Deepening the reform of agricultural and industrial water prices, one water price to users and one ticket to users, exploring the measured charge system and canceling water fee collect by per farmland; Exploring and seeking innovative mechanism of water price establishment and water collecting. Consulting with different price departments to study and establish methods of final water price calculation, and extending the range of water price justification. Besides, the standard of water price, which include basic water price, group management and final channel system repaired fee, be popularized to provide a basis of implementing terminal water price; In conditional areas, the price system should be propelled in the conditions of proper conditions.

Government should compensate those irrigation areas that run only on water fees and their water price dose not meet the basic need at present.

4.4. MANAGING THE SURFACE AND GROUND WATER IN A HOLISTIC WAY

There is a close relationship between the diverted flow from the Yellow River for irrigation, local surface water and ground water from the perspective of supplement and replenishment. All the water resources are managed in a holistic way to lift the irrigation water supply guarantee rate and maximize the efficacy of the water resource of all kinds.

A feasible water price policy should be available to guide water resources prioritized allocation.

4.5 ENHANCING CAPACITY BUILDING AND IMPROVING WATER RESOURCES MANAGEMENT CAPABILITY

PIM is new thing, which will take some time to be understood, accepted and extended. The training will play a crucial role in the process. Concerning the fact that farmers are the main body in PIM, it should be put in the first place to do publication to farmers, aiming at enhancing farmers' democratic awareness and spontaneous participation in public affairs. Training should also be given to farmers to raise their self-management capability and quality. Two aspects should be the entry point and the focus: (1) How to manage the water issues in line with the association's rules and norms and counterpart laws and stipulations in a order way. (2) How to maintain the projects, allocate water resources, save water, protect water environment and calculate water cost. Only by doing so can the farmer water use agencies be consolidated and develop.

Meanwhile, training should also extend to government officials and managerial staff, making them truly realize the roles participatory irrigation management plays in irrigation management system reform, and spontaneously give strong support Water Users Association. As the grass-root level, the staff in township governments actively cooperating in applying participatory irrigation management will significantly smooth the process in terms of the approach extension.

4.6 IMPROVING THE POLICIES, LAWS AND REGULATIONS SYSTEM AND PROMOTING ASSOCIATION REGULATIONS CONSTRUCTION

At present, China has "Village Autonomy Laws" and "Implementation Guideline on Hydraulic Projects Management System Reform ", which provide law basis on village autonomy and establishment of Water Users Association, NDRC, MOF and MWR as well as governments at all levels also mapped out relevant policies. All the policies safeguard the participatory irrigation management development in a sound and order way.

Water Users' Association is a NGO with independent Law Person qualification, enjoying autonomous management rights and financial autonomy. Though it has norms, which have clearly stipulated its obligations, rights and accountability, some issues might rise in its actual operation Therefore, it is necessary to establish regulations, set up constrictive and supervision system, such as "Water use management regulations", "Project M&O Management Stipulations", "Financial management Regulations", "Water Fee Levy and Use Management", and adopt public Notification System, etc.

5. CONCLUSIONS

5 The participatory irrigation management model has yet been applied widely in the LYRIA. The reasons behind this involve engineering structures, system, mindset and awareness, etc. To make it in place widely, the following should be on the top: to improve infrastructure construction, reform the existing management system, well establish water market, build up irrigation management capacity and perfect relevant policy, law and regulation system and Associations' norms.

.

IRRIGATION MANAGEMENT UNDER NEW ECONOMIC CONDITIONS IN RUSSIA

Kireycheva Liudmila Vladimirovna[1]

ABSTRACT

Under conditions of developing market economy in Russia budgetary appropriations of ameliorate system operation can be maintained only temporary. Therefore it is necessary to settle the reform problem for the operation service of the ameliorate systems and to find the new source of supply and financing of the ameliorate activity.

In the conditions of market economy the different types of the ownership for the inter-farm network are assumed (for example government, joint stock, etc.). The only one requirement is to provide the normal operation in the frame of collective usage. Measures, providing more efficient operation of the inter-farm network, are required. The construction of inter-farm irrigation and drainage network as well as inner farm systems is carried out using government budget.

In our judgment management pattern reorganization must be carried out in practice at the local level in the first place: ameliorate system bureaus; tractor forces; operation service bureaus; specialized plants and enterprises by their integration.

According to the irrigation systems' inventory data (2002) federal part of property of Ministry of Agriculture of Russia includes: more than 60 thousands hydraulic structures including 250 water reservoirs (30 water reservoirs with capacity more than 10 mln.m^3); 6 thousands of intake structures; 1,8 thousands pumping structures; about 56 thousands km of canals; 5 thousands km – barrels and protecting dams. Book value of these structures and systems is 43,5 billion rubles (28% of the total book value of structures and systems belong to the Ministry).

As the result of reclamation service reorganization carried out in 2002 special regional management bodies have been reorganized into the federal government institutions. Finally 75 federal government institutions named "Agency on reclamation and agricultural water-service" have been created in 75 subjects of Russian Federation.

1 - Vice-director, Dr.Sc.(Techn.), Professor, All-Russian Research Institute for Hydraulic Engineering and Land Reclamation, 44, Bolshaya Academicheskaya street, Moscow, Russia, Tel.007-495-154-12-26, Fax. 007-495-729-35-00,E-mail: kireycheva@mail.ru.

Federal government institutions on land reclamation implement state surveillance, management and maintenance of reclamation systems and hydraulic structures belong to the federal property.

As a whole, hydraulic structures belong to the federal property being in charge of Ministry of agriculture of RF the following activity is implemented annually: water intake and transport, including irrigation purposes; water-supply of populated localities and other purposes.

Reclamation and water organization department of the Ministry of agriculture of Russia implements complex of measures including: to put in order reclamation fund; to implement reclamation systems' operation; to develop material and technical base of reclamation systems.

Situation in the reclamation is being slowly improving now. Federal financing of reclamation measures becomes more stabilized, at the same time more rural commodity producers take part in reclamation financing.

Federal government unitary enterprises, regional authorities on land reclamation and agricultural water-service, providing inter-farm reclamation systems' maintenance, obtain budget financing which is not sufficient.

During the last years the most part of the agricultural enterprises has lost both internal funds and investment sources. And this is provided that retirement of the fixed capital stock fourfold exceeds fixed capital investments. Planned destruction both production and non-production spheres of agribusiness takes place.

The government level has to be responsible for policymaking, decision making, legislation development, and control and regulation development.

Regional authorities have to determine regional priority, to regulate inter-relations between federal subjects, to provide monitoring and control on the accepted decisions.

Local level laws realization is carried out as well maintenance and operation of the irrigation network and water economy management is provided.

Scientific-research institutes carry out the strategy of development, create scientific and standardization basis, approach on management transfer in irrigation, fulfill the scientific-research works.

Actors of irrigation sector reforms and their activity for the different stages and levels of irrigation management transfer are shown in the table 1.

Table 1. Role of actors and stakeholders at definite stages of IMT process

Actors and stakeholders	Policy setup	Policy development	IMT implementatic	Monitoring and evaluation of IMT
Government	Law “Concerning land reclamation”. Law “Concerning arable land rotation”. “Land Code”. “Water Code”. Law “Concerning hydraulic structures safety (reliability)”.	Conception on complex ameliorations development. Conception “Concerning soil fertility safety and rehabilitation”. Government statement “Concerning hydraulic structures declaring”. Standardization basis formation. Financial regulation (Federal budget).	Federal Program “Soil fertility improvement in Russia in 2002-2005”. Rules on putting objects into operation.	Main economical parameters on economical activity of agricultural institution (annual repots of the Ministry of agriculture Russian Federation).
Regional authorities	Regional Laws “Concerning land reclamation”. Regional Laws “Concerning irrigation development”.	Financial regulation (Regional budget).	Regional Programs.	Ameliorative condition of irrigated lands and technical condition of irrigation systems (monitoring).
Local authorities	Laws realization	Land rotation organization.	Systems on arable lands cultivation.	Estimation on ameliorative condition of lands and technical condition of irrigation systems.
Local water management organizations	Statement “Concerning Federal state institution accept”	Statement “Concerning ameliorates objects operation”. Statement “Concerning hydraulic structures supervision”. Instruction on pumping stations and hydraulic structures. Schedules on water utilization development.	Water management activity.	Initial information collection.
Water users associations				
Scientific institutes	Science research institutes accreditation. Rules on institute’s activity.	Conception “Concerning management transformation in irrigation. Standardization-methodical basis creation on IMT process.	Science research planning and implementation.	Authorized supervision implementation.
National government organizations	Irrigation implements perfection.	Staff training.	Participation in documents’ development standardization-methodical basic.	Purpose oriented parameters implementation.
International cooperation	Experience exchange on new institutions and organization creation on irrigation management and agricultural activity in the conditions of market economy.			

In our judgment management pattern reorganization must be carried out in practice at the local level n the first place: ameliorate system bureaus; tractor forces; operation service bureaus; specialized plants and enterprises by their integration in the Associations on water-reclamation activity

Association is a legal party operating as a government trustee. Functional duty of Association must include intra- and inter system network maintenance including their reconstruction and development; water and land resources conservation.

Government should provide legal and financial control the Association activity.

Association confederates water-managing organizations both belong to the actual government ownership as well as separated hydro-technical structures and intra-system maintenance service. Council of water-using farms having control and coordinate functions is organized under the frame of the Association.

Due to the modern economic and economical conditions enterprises, maintaining inter-farm network, belong to government and are formed on the base of operative management and self-support principals. Local, regional a Federal organizations co-ordination is provided with economical management and corresponding standards.

The main tasks must include:

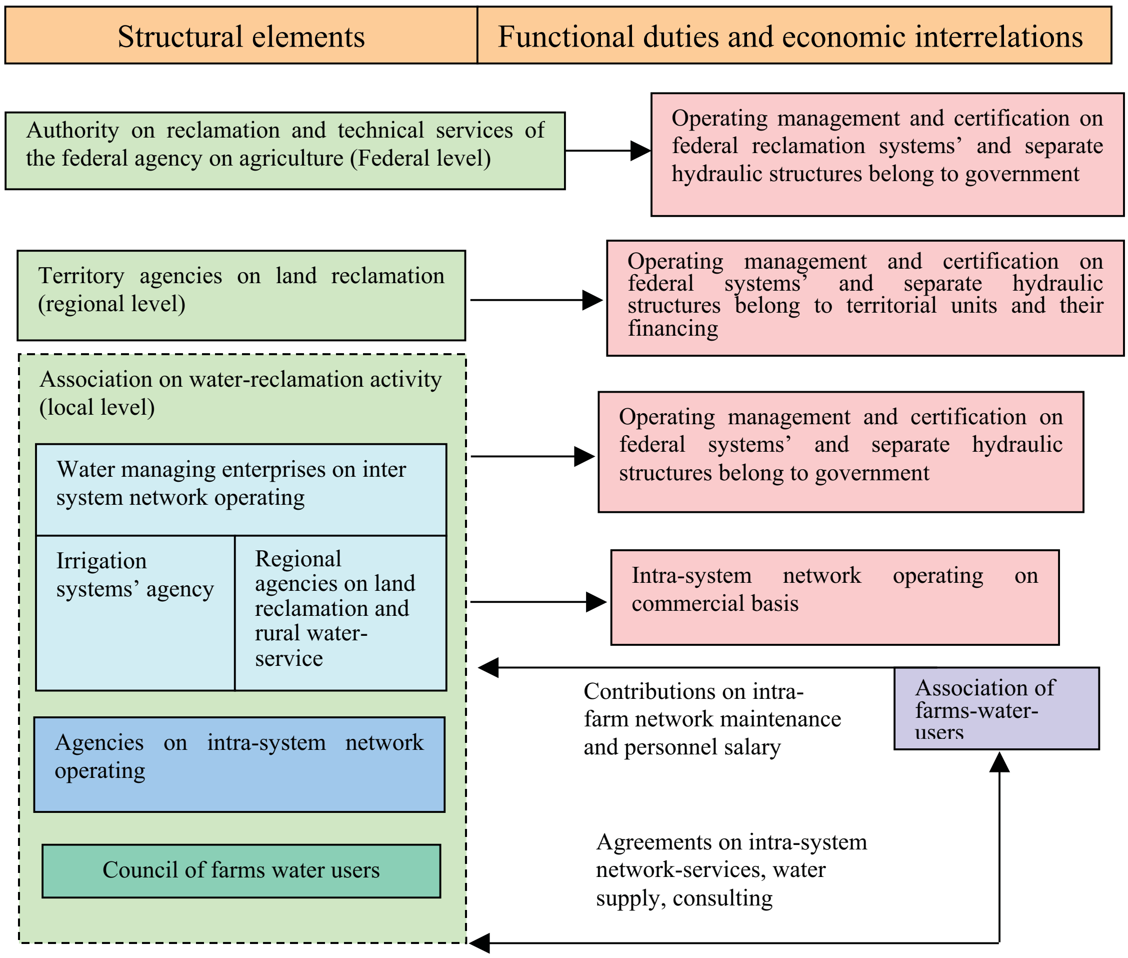
- render the main service, governing the proper water supplying conditions, water protection and prevention destructive water effects;
- coordination of water using plans;
- water using control within the industrial enterprises including waste water discharge;
- perspective and current water management planning (repairing-operating activity within the served territory);
- maintenance and operation financed planning for water managing systems;
- technical maintenance of the state reclamation systems and separated hydraulic structures belong to the government property;
- another water managing activity.

The users of water managing enterprises are agricultural farms belong to the different forms of property and private individuals. The relationships between water managing organizations and water users are regulated by agreements. The government finances water-managing enterprises. Besides the government landowners, commercial Russian and foreign organization can invest water-managing enterprises

Enterprises on intra-system ameliorate network operating are commercial, providing paid services on network repairing and maintenance according to water users' requests under Water-users Council control. They provide consultation services for landowners on land reclamation problems in on-line regime (irrigation rates, terms of water application, fertilizers and chemicals ameliorates application).

(Table 2).

Table 2. Organizing structural scheme on reclamation system



Water-users Council is formed on common terms with the deliberative vote providing control and coordination for the water managing enterprises at intra-system technical maintenance according to reclamation measures requirement. Water-users Council includes landowners located within the reclamation system territory.

Economic integration is built on the principle that it is necessary to provide all measures applying within the Association responsibility with financial recourses. To provide both sources of incomes, compensation for expenses and activity financing sales proceeds (production, services, and labor) are used. Drawing income provides both expenditures and tax rates covering and reserve for extensions.

In Russia strategy selection at water managing enterprises commercialization must include valid getting up for agricultural production costs in the irrigated lands and ways of payment realization for agricultural enterprises.

Property status of irrigation structures and canals, the ratio of own and government property, the terms of their usage require government regulation. Perspective optimum is the variant of such association where complex of constitutive works will be completed with the total privatization of water managing enterprises, serving farms – the members of the association.

Paid water using application must be preceded with several problems solving:

1. Water resources management perfection including inconsistency dissolution between legal and legislative base for Russia and its federal subjects: common application of informative technologies.
2. Irrigation systems' equipment with water-measuring facilities.
3. Make odds even difference in prices for agricultural and industrial production.
4. Government participation in agricultural expenditures' compensation belongs to payment for water using.
5. Perfection of promotion and crediting systems in agricultural and water managing activity.

Under actual circumstances budget financing retention both for water-using systems and inter-farm systems operation are suggested to be saved. Concerning financing at intra-farm network maintenance and operation contract basis is the most useful. On this water-users are given the state credit on the base of easy terms.

Design and construction works organization (customer functions) for water-using objects within the farm and infrastructure creation is under regional local organization responsibility.

Government participation in such kind of works is provided with the following:

- adjustment activities: state financing state financing; soft loan; preferential tax treatment;
- activities' stimulation, basing on the commercial activity of water-using organizations: water-using and conservancy works on the base of paid services; hydraulic structures and hazards risks insurance due to accidents.

At the same time taking into account capital-output ratio of water managing, it is necessary to provide for purpose-oriented budget financing. Government financial resources can be given for hydraulic structures construction and reconstruction, water supply of rural population, irrigation, water bodies' monitoring, flood control, water bodies' protection.

The groups of water users should to be given association status as legal water users. It is efficient to create territorial associations providing control and discussion of agreement between farms and Association implements.

Water using system can include authority on water reservoirs and dams operation including their activity on the base of industrial and domestic payments; canals, pumping stations and irrigation systems authorities; separated enterprises realizing water intake from water using system directly. So as the rate foe water intake is evaluated as the mean value for the water using system, water reservoir and dams' authorities have to evaluate individual calculating rates. They serve for rearrangement financial assets incoming as water intake payments. They are redistributed between water reservoir operation authorities having their individual calculating rates below or above the mean specified rate for the water using system. The total sum of budgetary revenues from water intake rates will decrease by the financing rates, which is necessary for reservoirs and dams authorities operation.

At the operation stage it is most rational to determine preferences at irrigation water delivery rates specifying. Compensation measures mean water delivery rates decrease excluding some expenditure elements for example depreciation deductions, profit tax.

At the water using stage compensation means total or partial water users costs recovery by the government. In this case compensation sum is given directly to the water users by the purpose-oriented decision. Today the above mentioned belong to the payment for water intake from the water source. Water Code of the Russian federation and Law "Concerning payment for water bodies usage" agriculture grant temporary discounts for free water intake.

Water intake rate is determined by effecting expenditures for water recourse regulation and distribution, its rehabilitation and reproduction. The above measures today provide on the base of government financing and by government organizations. Under circumstances of market economy it is unavoidable to establish water intake rates for all water users including agriculture. Water intake rates record at water delivery rates is determined with accurate and proper water losses accounting at water delivery. Water intake rates establishment leads to economical relations with water users having irrigated lands without operation service from water using organization but occupying up to 25% of the available irrigated lands. Water intake for these lands irrigation equals 10% of the total water intake into the inter-farm irrigation network. Water intake rate for irrigation purposes must be collected using uniform tariff for all water users, having been established for the given water source (water using system). In agriculture the above water intake rate must be introduced stage by stage in concurrence with the other type of rate – for water delivery. The Federal or local budget must cover imperfection amount of financing recovery. Water intake rate value must increase together with agricultural production profitability growth.

Agribusiness development is admitted to be one of the main priorities of the government economic policy. The strategic tasks of this policy are the following:

- in the field of economy – to form effective production in agribusiness promoting food safety of the country and economic integration to the world market;
- in the field of social system – to improve pattern of life for rural population, to develop rural infrastructure;
- in the field of ecology – to product safety food goods; natural recourses conservation on the base process improvement.

Executive offices of the Federal authority must provide general rules for agribusiness markets operating and their unity within the territory of the country. The following directions are very impotant:

- to maintain stable food support of population;
- to pursue the structural policy;

- to pursue effective foreign economic and financial activity;
- to pursue integrated technological policy (to support land reclamation; to set integrated norms in agribusiness; to realize purpose-oriented programs; to form and to finance basic and priority applied researches in agriculture);
- information support improvement (to create and support government information support system for agricultural market; monitoring on results of agricultural policy-making;
- methodical and organizational support of structural drastic alterations in agribusiness;
- governmental supervision.

To restore the health of rural economy restructuring of farmers' credit indebtedness is necessary. Objects having been incorporated into purpose-oriented programs so as budgetary organizations and nature conserving objects requiring construction or reconstruction must be financed on the base of federal budget.

One of the chief directions of the government credit policy will be attraction of private investments into the agribusiness. Specific character of farming and other forms of rural enterprising should be taken into account.

As agriculture intensification causes pollution both crop yield and environment, government will implement measures on agricultural production adjusting up to ecological standards to reduce contaminate pressure on the environment.

Russian agribusiness analyses, having been carried out in "Conception of agricultural reclamation development in Russia" (2004), have shown that the irrigated lands in Russia should be increased up to 10-12 mln. hectares, drained areas should be expanded up to 7-8 mln. hectares to provide stable development of the Russian agriculture. The biggest irrigated region must become the following: Povoljie which can develop up to 3,2 mln. hectares in prospect; Western-Siberia region – 2,2 mln. hectares; the southern Federal region (SFR) – 2,1 mln. hectares. So the share of reclaimed area can be increased by 8-10% from the existing agricultural area.

The main financial resources for reclamation development should be budgets both federal and local. In these latter days, budgetary funds are reduced, budget funds redistribution in favor of local budgets (Budgets of Federal subjects) taking place. Supposed volumes and costs of hydro-ameliorative , cultivation, soil erosion protection works are shown in the table 3.

Table 3. Supposed volumes and costs of hydro-ameliorative , cultivation, soil erosion protection works

Types of works	Financing requirements		Suggestions for future period 2006-2010	
	Area, thous.hec.	**Costs (2005), mln. rubles**	**Area, thous. hec.**	**Costs (2005), mln rubles**
Irrigation systems reconstruction and restoration	952	147560	500	77500
Drainage systems reconstruction and restoration	957,6	68158	300	21334
Irrigation	200	24800	25	6200
Drainage	80	8928	20	2232
Cultivation and territory preparation	1000	18600	300	5580
Destroyed soils rehabilitation	300	5580	200	3720
Construction of soil erosion protection structures		1240		868
Development of operation service for water using enterprises		4960		3720
Inter farm ameliorate network and structures repairing		8680		6101
On farm ameliorate network and structures repairing		24800		15500
Construction according to investment program and hydraulic structures safety		12400		6989
Operational costs		14880		14496
Total		347234		164240

Today "Conception of soil fertility and agri-landscapes conservation and restoration for agricultural lands as the national property of Russia for the period 2006-2010" where the volume of the future works on land reclamation is determined (table 16).

Draft conception "Soil fertility preservation and reestablishment for agricultural lands and agro-landscapes of Russia in 2006-2010" has been developed by order of government of Russian federation. This conception contents approach basing on the complex, ecologically safe and economically rational combination of all types of reclamation measures to improve productivity of agricultural lands.

One of the most important factors of soil fertility reproduction is irrigation and drainage measures together with contra-erosion measures, agro-chemistry and afforestation and other reclamation measures. Proper combination of above mentioned erasures provides complete utilization of potential soil fertility without soil degradation.

Within the reform conception for the budget process in The Russian Federation in 2004-2006, being approved by the Russian Federation government dated May, the 22nd2004 N 249, is said that purpose-oriented programs must be devoted to large-scale investment, scientific research and structural problems solving. These problems belong to the sphere of the Federal authorities of Russia.

REFERENCES

1. Conditions and measures on agri-business development of the Russian Federation. Annual report, 2003, Moscow, 2004.
2. Development strategy for agri-business and fishery, MSX, 2005.
3. National program "Water of Russia – XXI century", MRP, Moscow, 2004.
4. Program on soil Fertility in Russia 2002-2005.
5. Conception on soil fertility and restoration for agricultural lands and landscapes as national property of Russia, RASXN, All-Russian research institute of irrigated crop farming. Moscow, 2004.
6. Federal Law "Concerning land reclamation".
7. Condition of irrigated and drained agricultural lands and technical conditions of irrigation and drainage systems (01.01.2004 data), Ministry of Agriculture of Russia, Federal Agency for Agriculture, Moscow, 2004.
8. The main economic parameters of financial-economic activity for agricultural enterprises for the period 1999-2003, Moscow, 2004.

PEOPLE'S PARTICIPATIONS ROLE IN WATER RESOURCE MANAGEMENT OF EAST AZARBAIJAN AND ARDABIL PROVINCES

Farhad Paknia[1], Seyed Alireza Hosseinzadeh Tabrizi[2], Farhad Almaspour[3]

ABSTRACT:

During the past five decades, the trend of management based on the people participation has been weakened by considering new form of water resource management, and generally, the role of people participation in the drinking water supply of rural and urban areas according to technical & environmental requirements has thoroughly been changed. Thus, the people presence in this section of activities has been omitted and people participation was limited to the distribution of irrigation water and preserving of kanats and structures. Recently, new stage of People's participation system in the water resource management of the country has started with initiating financial public participation for construction of irrigation networks. Notwithstanding, this desirable process shows deep dependence of public interests to collective activities in the history of this country. Nevertheless, these changes in comparison with huge abilities of people as in the history of management based on collective cooperation in the water affaires has been displayed which to be very slight. Dependence to the potential capacities of people and stakeholders is a fact that global society and international conventions believe in that too, and regarding to this matter, vast activities are enforceable. Necessarily, research and knowledge of different dimensions of public participation specially recognizing its dimension in the history of public participation in the water section was one of inevitable principal activities for entrance to huge boundary of this subject. Through such a scientific recognition and with notice to planning and preparing of integrated system and construction of public participation, subject of public participation in water section could be completely sustained by dependence to deeps believes of people. According to the policy of Ministry of Energy based of combination of vast public potential abilities with public income resources in the construction of irrigation and drainage networks with decline target of projects construction time and assurance to their correct operation and finally managing the main section of public income resources to the economical infrastructures , East Azarbaijan water Corporation, during the second and third development , economical , social , cultural development

1 - BS in management/ People participations and Investment Office, East Azarbaijan Regional Water Authority (E.A.R.W.A), Tabriz-IRAN. Tel: +981 411 3382232, farhadpaknia@yahoo.com
2 - MS in Hydraulic Structures,/ Subscriber Affairs and Surface Water Resources Users Office, E.A.R.W.A, Tabriz-Iran. Tel: +981 411 3382309 and +981 9144150241, alialireza@yahoo.com
3- MS in geographic information systems, / planning Office, E.A.R.W.A, Tabriz-IRAN.
Tel: +981 411 3382306, f_almaspoor@yahoo.com

plans of Iran along with water resources development of two provinces succeeded to establish 133 water users cooperation's (and 46 projects to cover 72595.575 hectares of land) with 10900 water users. In addition, 21 projects of participation projects started operation in the half of this year. In this article, we briefly explain the most important activities which have been done, revealing the problems and difficulties about the public participation.

Key words: E.A.R.W.A- Public participation - irrigation – public networks – water

1-INRTODUCTION

In the recent decades, the integrated development by multilateral participation of all people in development plans has been experienced in some countries and this problem has brought useful results to these countries. For our country, the experiences of these countries are more useful than experiences of development countries such as American and European countries.

If we study the history of mankind's life, we will notice that the man always has tried more for creating his special location in the environment; so that the first societies were created and in that society sense of participation for recreating society and living place were strengthened, and they had no the other resort in their thoughts except mutual cooperation and understanding with other societies. The direct and indirect participation of all people in the structure of society were completely apparent.

Participation in rural society is more important, because distance between government organizations in the cities and beneficiaries of these polices in rural areas is more.

To get an effective participation in development should be recognized and solved. Concept of participation is extensive and polyhedron and social and cultural concepts should necessarily be examined from expertise viewpoints. Specific solutions, acceptable and logical methods should be collected and selected by considering the cultural, social and economical specifications of each area.

The necessity and the importance of people's participation in development plans are:

1. Participation is precondition of development.
2. Participation is a key element of planning.
3. Participation is guarantor of successfulness of government plans.
4. Participation is a basic stone of current affairs of society.

Through participation, knowledge or belief of villagers about development plans and absorption of their helps may be obtained.

2-THE ROLE OF PARTICIPATION IN DEVELOPMENT:

Generally collective participation of people makes the following three type of change in individuals, such as:

1. Change in individual's knowledge level: his or her information level and habit,

2. Changing in her or his skills level: method of doing mental and physical pieces of work.
3. Change in his or her structures and views: behavior, intends and viewpoints of peoples about society problems. The scientists and researchers has summarized the role of villagers' participation in socio-economic programs as following:
    1. To make incentive and readiness in people for changing continuous socio-economic and cultural situations and to accept plans and projects.
    2. To make risking morale in villagers for encountering with problems and finding their solutions.
    3. To raise decision- making power in people to designing plans and development projects for strengthening innovation sense.
    4. To make changes for guarantying development plans by people's participation in all planning phases.
    5. To help to the regulation of power structure in society and to make changes in power distribution by giving ability to the people or to receive power with them.
    6. To accelerate the trend of accomplishment of projects, save the time of accomplishment, and increase the quality of rural programs.
    7. To help for logical exploitation of projects and projects.
    8. To get more information about programs and problems of society and find solutions for them.

3- BARRIERS to VILLAGER'S PARTICIPATION:

Villager's participation needs the specific conditions and situations, if these conditions not be provided; in this case villager's participation will encountered with serious barriers**.** For better understanding, here we present the following necessary bases:

3-1 The historical bases: one of the effective factors to attract villager's participation in different development programs is the culture of participation and social morale of participants. This morale when will be appear that a historical root be exist and it has a long history in their life environment and villagers have experienced a sweet taste of cooperation sense. In these conditions, participation has logical and good results. In our country, there are a few cultural and religious bases for participating in social affairs such as building mosques, kanats, Caravanserai and the other public places. Furthermore, different production methods and social life have made the different types of participation with special formations. The formations like Boneh, Sahra, Haraseh etc are feasible samples of people's participation formations. Social and economical changes and the other changes have altered the traditional forms of participation. As the result of that, social and economical relationships have also been changed. Nowadays, planning methods and organizing participation with proportion to the enhanced technology level is the main issue.

3-2 The Political barriers: Planning system has a direct relationship with the governmental and official system of each country in the national, regional and local scales. If a society has a central government system or autocracy system, in this country participation system will not be profitable. The wide interfere of a minority group or a person in the political decision-making and managing affairs weakens democratic participation bases. So, condition of participation existence in the local and rural level is the existence of democratic and political system and also decentralized planning system. Furthermore, in order to establish a logical participation system at the villages, this system must be created in the socio-economic structure of the villages so that it could design a suitable participation status and then be accomplished. This work is a duty of experts and government individuals. Because sometimes pressures of political tribal groups and inter-group dependences could be an obstacle to attract participation of the majority of people and sometimes the existence of local powers and their enjoyment of a good socio-economic base at the village can be a serious obstacle to the participation and decision-making activities. There are a few specific ways to guide the people to have socio-economic cooperation that these are the duties of the governments. The governments must consider a priority to the cooperation sector in the economy of our country. One of the reasons of failure of economic and government system to attract people's participation is political interference and ignoring the traditional methods.

3-3 Economic obstacles: Beside the internal conditions, participation needs external conditions that here the main conditions are socio-economic conditions. Participation mechanism must be achieved free from political unsafe economic competitions. Attracting people's participation at the development and economic plans depends on the economic abilities of the peoples. Because of low incomes, the majority of the villagers of IRAN have no the ability of participation. In different countries such as India and Korea, the factor of economic poverty is one of the main barriers to the people's participation. Furthermore, poverty of rural groups weakens effect of their efforts and also weakens their interference and participation in decision-making and their participation in the establishment of development plans. Participation trend may strengthen the economic base of the villagers. The role of the government is very important to reach this goal. The feasible sample of this participation policy can be found at the Samoel Andog's Revolution in Kora republic that was designed to the participation of the villagers in order to increase revenues of villagers. The effect of this movement and preparation made deep changes at the villages of Korea republic so that in 1974 income amounts of majority of villager's households became more than households of cities.

3-4 Cultural and Social Obstacles: Cultural and social factors are the other effective factors on people's participation as a relational canal for socio-economic development.

Generally, there are a few local pressure groups in the villages, these groups are agent of profits of powerful individuals that weakens local formations and seldom strengthens them. The choice of local leaders as local people agents is a suitable social factor to reach the participation. Production groups of volunteer societies, farmers groups and women associations are samples of the participation local organizations.

4-THE SOCIAL, CULTURAL AND ECONOMIC BASES TO REACH THE PARTICIPATION:

Development process is a trend that the economic, social and cultural situations of rural and urban societies are improved by popular and government efforts. This implicated process of development includes two principal elements, one of which is people's participation and their effort to improve their life level. By self-helping and local innovations; and the one is instruments provision and necessary techniques are provided by government. This bilateral cooperation of people and government makes development plans becomes effective.

4-1 The Cultural and Social Bases: Generally, participation is a type of interaction between values, goals, factors, activities etc. In fact the interaction between these elements is an interaction between the experience and the interpretation of participation. We must also examine the existence of social base. This base is a result of two following experiences and examinations.

Generally principals of the participation to the people are following cases:

- Participation is a part of the cultural and social system and it originates from the society.
- This participation is the result of popular power not individual power and people by using that can access to the social and economic security.
- Participation is as a goal for the villagers not as an instrument.

4-2 The Result of Interaction between Two Experiences about the Participation: On the base of the participation between two experiences "to the government" and "to the people" conditions are provided that confronts people's participation with problems. These conditions contain these specifications:

- Participation is a risk to the people.
- Because the original plan is provided by the upper levels of the government, and people has no interference in the phase of the decision-making and planning, so people see themselves without power in the establishment of development programs.

5- PROCESS OF THE PEOPLE'S PARTICIPATION:

5-1 Process of the Participation: Generally process of the participation starts with a phase of need sense and problem knowing and then a base and an incentive is provided to the popular activity. At first, this activity continues as an informal form and then as a formal form and finally the result of this popular activity is participation. The process of participation is composed of these following phases:

1. Need.
2. Problem knowing.
3. Incentive.

4. Group formation.
5. Group organization.
6. Formal activity.
7. To reach the goals.
8. To examine the goals.
9. Satisfaction.

5-2 Conditions and Necessities of the Participation: Conditions and necessities of the participation that has a direct relationship to the participation process fulfilled in this following framework:

1. To know the goals of a problem, to know the problem and to have enough incentive to popular activity.
2. Interactive informing and interaction after establishing initial groups.
3. Membership, consultation, independence after forming organized groups.

5-3 Process of People's Participation: Phases of the participation in different fields are following cases:

5-3-1 Phases Concern to the Participation Process: Planning is a dynamic, flexible work and the result of planning to design the targets, policies and methods of work.

- Organization: to part a work to the different parts, to leave the works and to make changes in a system that the results are controlled.
- Promotion: it includes effective guidance, to make relationship and to provide incentives to participate.
- Control: to control concerned activities in different phases of participation process.

5-3-2 Methods Concern to the Promotion to Participate:

- The interference and the examination: to be in an area and to help or consult with local people.
- Mobilization and discussion: to make interests and information about framework and targets of plan.
- Advertisement and effort: to advertise the information about plan.
- People employment: to attract people supporting and helping and to base the local organizations as a protection tool.
- Adjacency: continued interference, education and establishment of plans in order to develop areas.
- Explain: to experiences.

6- STRATEGIES AND ORGANIZING PROBLEMS PARTICIPATION:

6-1 Participation Strategies: there are a few important strategies of people's participation such as:

1-Participation strategy as an investment: there is a specific difference between participation as an investment and as a target. Participation as an investment is people's participation in order to help to each other, to provide financial resources to establish development plans and to arrive to the forecasted goals. In the participation strategy as a goal, people have the main role in decision-making about establishment of plans.

2- Participation strategy in development plans: development strategies are fulfilled by promotion, active employing and organizing the people to design polices and plans.

6-2 organizing the participation: certainly grouped organizations have a powerful tool to ease accessibility to the development and specially establishment of water resources development plans. To know the social and economic distinctive groups as a basic unit of development is very important. Organization is a precondition of any activities, so the relationship between the organization and the participation is a specific part and are presented these following cases:

6-2-1 The process of making group: this process means to arrange and it includes "research in the village", "choice", "distribution of responsibilities", "to define duties", "the examination of providing financial resources to establish plans" and planning. These groups, as an organization is a means to participation of people in the process of development and to establish plans.

6-2-2 the problems about organizing groups to participate:

1. Forming: to form the groups to participate in plans.
2. Membership: this is based on the common economic benefits.
3. Meetings of groups: these are the main spaces to transfer different opinions, to say the goals of plans, timing work plan and coordination and leadership.
4. Structure: group must have an internal structure so that by it to access to an organized base and by using that can get to the participation.

6-2-3 Agent and the main duties of participation: in order to have an effective people's participation and an organized group to establishment of development plans needs an agent so that it can ease the process of participation. Certainly, a participation agent is an important factor in the process of participation. The main duties of participation agent are:

- To help examining of socio-economic of a region and the villages around that region with cooperating groups.
- Leadership and to help to the people in economic activities, to improve production situation and socio-economic infrastructures and to plan and to help to the small groups to do economic activities.
- To provide continuous promotion in order to do self-confident activities and to promote problem solving and decision- making inside groups.

- To provide a relationship between financial protective groups and to help educating of members of groups about participation easing.
- To help the groups in order to move towards good efficiency.

7- SOLUTIONS OF PARTICIPATION:

7-1 General solutions of participation: some solutions of the villager's participation are:

- To change planning system and moving towards decentralized planning system.
- To promote public culture at the society and people by using tools and cultural values and general relationships.
- To make interactive confidence between official organization chiefs and people.
- Planners must notice to the injustice balancing policies, renewing of education system, justly distribution of possibilities and chances, popularizing social services in order to promote people's participation.
- By using possibilities of research and consulting organizations in order to know cultural, mental and social specifications and to examine the needs of rural and urban needs, the integrated and precise studies muse be done.
- To arrange and organize personals in order to guiding participation by official organizations.
- To do the cultural activities in order to omitting the existence organizational culture of governmental organizations on the base of dependences to the general benefits of government and to promote the culture of people's participation.

7-2 Practical activities to achieve people's participation: recognizing need and practical activities to fulfill participation affair depends it's all the phases are specified with noticing to it's needs and conditions and establishment activities must be collect with notice to the cultural and social structures and specifications of each areas. These activities are as following:

1. To know precisely cultures and economic activities.
2. To change thoughts of rural and urban people to life, work, production and future and specially the necessities of areas development.
3. To make people interest in projects and goals of development plans by short stories, texts, local poets.
4. To make story films for fulfilling activities and to broadcast them in different areas.
5. To know the special stakeholders.
6. To make competition between different groups of people is one of the social potentials to financial participation.

7. To make primary and basic groups those basis elements to inform formal organizations and formations are provided. By these agencies, to get bank facilities and repay these facilities become formal.
8. The existence of a promotional organization is a basic element of fulfilling people's participation by educating the beneficiaries and to have good relationship to them.
9. Finally, if all the villagers don't participate in the process of plans design and establishment, their real needs and benefits aren't provided.

During recent decades, the activities that are said upper lines were experienced in the villages of functional boundary of Regional Water Authority of East Azarbaijan. This activity during a time more than a decade has brought new experiences to this authority specially created a good and continuous relationship between people and this authority and became a base to have a new movement. The effect of these activities is continuance of people's participation in the national and large plans.

8- THE HISTORY OF PEOPLE'S PARTICIPATION AND FORMATION OF WATER USER'S COOPERATIVE IN THE REGIONAL WATER AUTHORITY OF EAST AZARBAIJAN

8-1 functional framework:

The activities that has been done in the beginning of formation and during activity years as a executive way to form people's participation in the Regional Water Authority of East Azarbaijan has been in the following framework:

1. From the beginning of forming of discusses about people's participation, in this organization using of services of experienced managers and experts that further to have believes to the discusses and affairs about people's participation at the financial problems, they have had enough knowledge about people's participation in the operating and planning of development plans and familiar managers as one of an effective parameters to inform people's participation have been used in this organization. This subject has been examined in the establishment phases with more sensitivity.
2. After a decade, this reality is completely obvious in the functionality and report card of activities about people's participation affairs of this organization that in a set of practical and theoretical activities, using of services of university professors, researchers around this area has been one of the most important activities and besides establishment activities and before starting these activities, to receive different opinions and viewpoints of researchers and thinkers has been as an important factor to determine activities about people's participation. Because the sensitivity of social problems makes before doing any establishment activity, by using theoretical bases and to combine these bases with experiences, the best routes are determined and then selected.
3. To pass different explanation seminars, to have different meetings to political persons such as governors, deputy-governors, Islamic bureaus, agriculture managers, parliament agents, cooperation organization, planning and management

organization, agent of banks in order to define different problems about people's participation such as to define the cases of act and prescriptions to gain practical activities have been the most important activities of people's participation to make coordination to charges. This important activity has been noticed as a necessary and precondition activity of people's participation affairs before starting any establishment activity. Because of sensitivity of this subject and problem, the straight belief in this organization is that coordination to other offices and organizations has a basic role to continue people's participation and this problem in different times has been experienced during establishment activities and it's positive effects in the process of establishment activities has been proved and it's beneficial results has been sensed.

8-2 Practical activities:

1. *The first phase is before starting theoretical discussions* (up to 1994):
2. In this phase, the attraction of people's participation limited to the small plans of water supply to the agriculture and especially to the farmer's participation to transfer lands of water structures establishment place without paying prices of lands that are located in the routes of plans establishment.
3. *The second phase in the framework of people's participation committee (since 1994 to 2002):*
4. To provide the bases and to attempt to provide knowledge and belief to the managers and experts and the other agents about people's participation by passing conferences with parliament agents, planning and management organization and the other political and official persons, to inform water user's Cooperatives by water authorities and general office of cooperation in the villages that covered by water resources development plans.
5. *the third phase, practical activities to the field of common cooperation between water organization and Jehad-keshavarzi organization(from2002 to now)*

Functionality of People's participation office in the part of water user's Cooperative in 12 yearly time distribution(94-2005) has been shown at the following table and changing some cooperation parameters have been shown at the diagrams 1 to3:

Table-1: Functionality of People's participation office in the part of water user's cooperative in 12 yearly time distribution (94-2005)

Type of activities/Year	94-95	96-97-98	99-2000-2001	2002-2005	1994-2005
Number of plans	3	6	13	17	39
Number of cooperatives	15	24	13	81	133
Number of beneficiaries	2428	1956	1988	18736	25108
The are of lands covered (hectare)	5042	12219	4232	111912	72596
Amount of bank facilities(million rials)	2798	41760	53090	627970	688620

Diagram 1: Number of participation plans

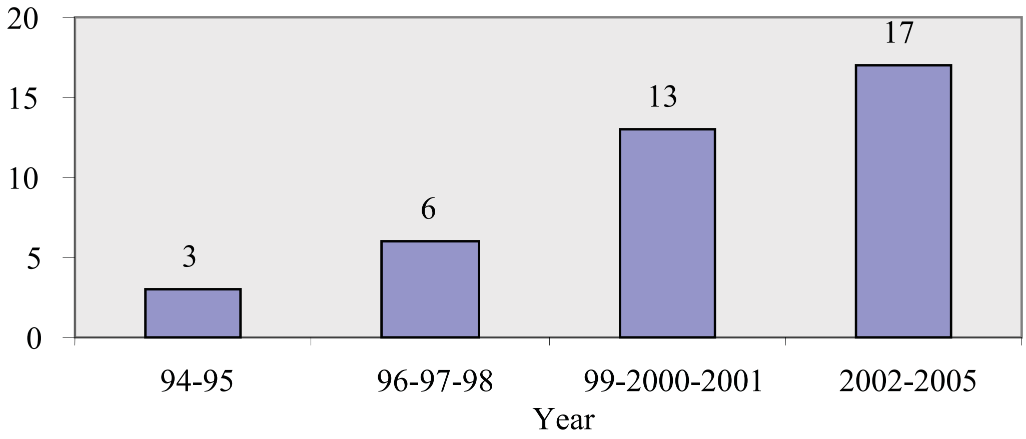
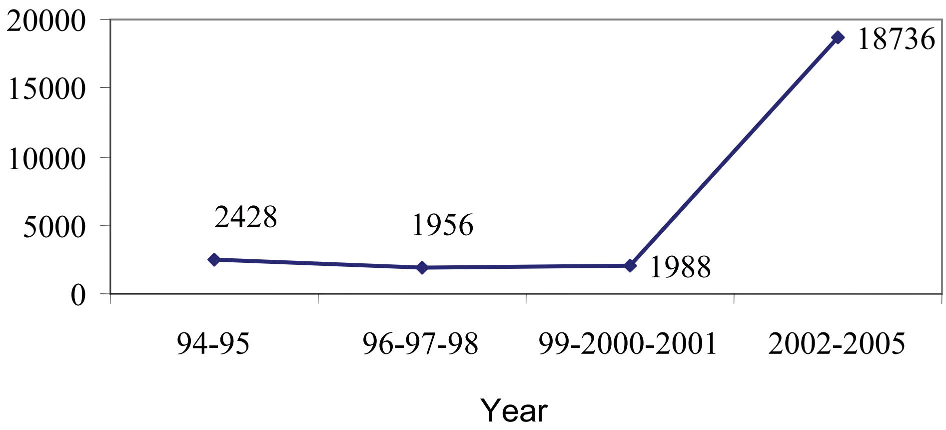
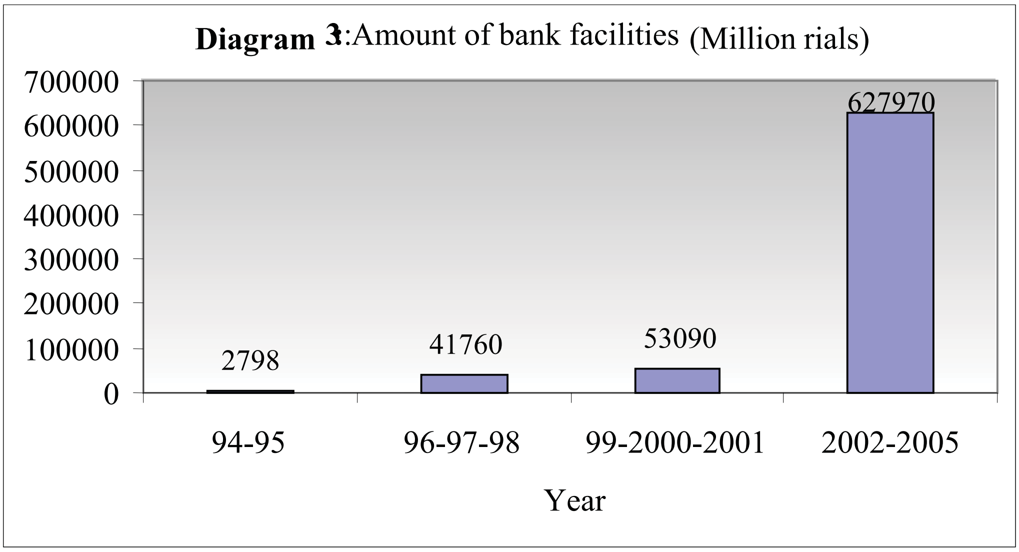


Diagram 2: Number of beneficiaries





It must be said that on the based of forecasted necessities in the legal points of water and agriculture of the third plan has provided a good opportunity to make relationship between the effective factors in the common affairs of irrigation and drainage network lands. Specially, a very relief role to people's participation and to do social studies and to write and operation system in water resources development is considered by legal points 106, 107 and the report of consume optimization of agriculture part. About this problem, a common cooperation document in order to fulfill the forecasted legal duties in the cultural and socio-economic plans of the country was collected.

Figure 1: Beneficiaries survey projects

9- CONCLUSIONS

The analysis that has been done in this paper shows that participation is a precondition to develop and without villager's participation development will not be enquired.

The investment of government about this problem is necessary and development of villages is not completely depend on the government investment and the subject of participation depends on the cultural and socio-economic conditions of villages is examined and then about that problem is decided (amount of government investment and villager's participation). On the other hand, powerful backgrounds of participation existence between people has been experienced during the history with depending on the conditions of the time and different places of IRAN and its conditions has been changed by government system changes, but in spite of the existence of long-period history a systematic form of people's participation has not been organized in different activities specially to its economic forms. The experience of people's participation in the operation of ware resources like the other forms of people's participation has been affected by different reasons and testimonies and during the history by the effects and interferences of modern managements, as the form of water resources management and a set of activities have been completely changed. Water resources management that has been changed to the today's form according to the principals of water industry, there wasn't in 50 years ago because during last half of century systems of beneficiaries of water resources have been depended on the activities that were organized by people and there weren't today's direct interfere in the water resources management. Although to make today's form of water resources management was inevitable because of population growth, industrialization of cities and development of civilization, but the absence of people in decision-making and nonuse of people's abilities in today's water resources management cycle is the main weak point in the process of water resources management cycle.

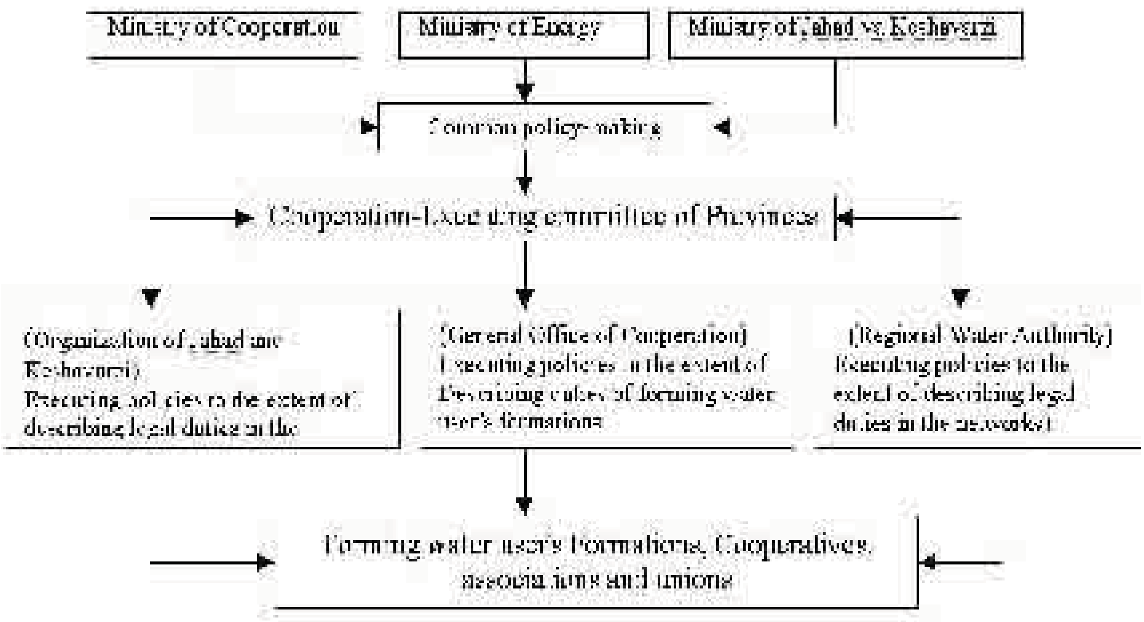
Many experiences of people's participation in the last decades about the operation affairs of water resources and the effective and successful experiences from establishing the first and second plans of the cultural and socio-economic development and specially the experiences of note 6 and 76 of the second act of development plan to establish water resources development plans shows this fact that to notice and to design the main place of people's participation has been the necessity of fundamental growth at the water resources management of the country and about this problem, it is necessary that by collecting and combining of past experiences and new finds, the new and accepted form of people's participation organization in the third plan of cultural and socio-economic development has been considered in the band A and article 106 and then be executed and this matter must be noticed in the fourth development plan as a title of band Te of the article 17 so that substance of development really be based.

10- SUGGESTIONS:

1. Forming a controlling and appraising core of the acts and the routine methods of people's participation plans includes the Ministry of Energy experts, the Ministry of Jahad va Keshavarzi, the Ministry of Cooperation and consultant engineers in the development office of the Energy Ministry and to recognize the weak and power points and to provide performing outline of the fourth plan and to define

the relationship between the Ministry of Energy, Ministry of Jahad va Keshavarzi and Ministry of Cooperation as following flowchart:

2. Applying the social studies in the Regional Water Authorities by using experienced humans and experts and finally to guide consultant engineers (to write master plans by the organization of management and planning).
3. Examining and appraising really performance of the active water user's Cooperatives and to recognize the problems in order to improve the exist conditions and to make necessary coordination in the Ministry of Energy – Cooperation and the Ministry of Agriculture in order to exert the common encouragement policies and to provide guaranty to the prices of agricultural products.
4. Planning of systematic educations by related organizations for cooperatives.
5. To use the experiences of successful countries especially Asian countries must be noticed and to transfer the knowledge and experiences by sending experts to these countries.
6. To say and explain the role of people's participation as a fundamental part of development and its role to govern the social justice to the people by popular Medias.



Flowchart-1: Organizational relationship to inform water user's Formations.

REFERENCES:

1. Maesoomi, Kaveh-Operation Authorities of Networks and People's participation –Water and development Magazine of Energy Ministry-Number 2.
2. Sahebi, Sadeg- Operational Strategies to beneficial participation of beneficiaries. Water and development Magazine of Energy Ministry – Number 9. Autumn.
3. Okly, Piter and Marsden-
4. The methods of participation in rural development- the ministry of Jehad and Keshavarzi.
5. Farhad paknia – Regional Water Authority of East Azarbaijan and Ardabil-people's participation.
6. Tagavi,Neimatollah- Social Participation and Rural Development-

WHY BLUE PRINTS ON ACCOUNTABILITY OF WATER USER ASSOCIATIONS DO NOT WORK: ILLUSTRATIONS FROM SOUTH KAZAKHSTAN

Kai Wegerich[1]

ABSTRACT

Since the collapse of the Soviet Union there have been two major changes in the agricultural sector in Kazakhstan. First agricultural production changed from centrally planned large scale state and collective farms to small scale private farms. Secondly, the water management of on-farm irrigation system was transferred from hydro-technical units to WUAs. The creation of WUAs in South Kazakhstan is based on blueprints, which promote equity and accountability. The paper critically evaluates the existing blue prints of WUAs. It is argued that even these blueprints do not live up to the spirit of equity and accountability of the organization to its members and between members. Examples of WUAs in South Kazakhstan are presented, which shows weak organizations, lack of accountability and farmers which are not empowered to change their own organization.

INTRODUCTION

In Kazakhstan, during the Soviet period, agricultural production was structured in state and collective farms and on-farm water management was organized by specialized hydro-technical units of these farms. Land reforms divided the large scale farms. Irrigation management transfer (IMT) and the creation of Water User Associations (WUAs) seemed to be a promising solution to keep up the irrigation infrastructure and to take over water management and delivery to a vast number of small private farms.

Fieldwork was conducted from October to December 2004. Within this period interviews were carried out with main stakeholders in international organizations working on training for newly independent farmers and WUAs, staff of district and province water management organizations in South Kazakhstan, as well as WUA staff and WUA members. The paper utilizes collected data from two districts in South Kazakhstan province, Turkestan and Makhtaaral.

1- Affiliation: Irrigation and Water Engineering group, Wageningen University, Nieuwe Kanaal 11, 6709 PA Wageningen, The Netherlands. Phone: +31 317 482750; Fax: +31 317 484759;
e-mail: wegerich@yahoo.com; kai.wegerich@wur.nl

The paper continues with a short background section on land and water reforms in Kazakhstan since independence. This is followed by a discussion of the current blueprints of WUA organizations, their accountability, their rights and responsibilities towards their members and vice versa. The next section presents the data of the assessment study of the WUAs in the two districts in South Kazakhstan. The last section concludes.

BACKGROUND: LAND REFORMS, IRRIGATION AND WATER MANAGEMENT

Even though Kazakhstan started its agricultural reforms in 1992 directly after independence, only the introduction of the Bankruptcy law (December 1998) let to a rapid expansion of private farms. By April 1999 already 84,766 peasant farms were established. The irrigation system in Kazakhstan was designed for large scale farms and mainly for one particular crop. The state and collective farms were responsible for the operation and maintenance of the on-farm water management infrastructure. Already during the Soviet Union period there were maintenance problems with the on-farm irrigation systems (Bucknall et al 2001, p.5). A TACIS report (1995) points out that often the most convenient method of irrigation for farm management was chosen. This implied low flow rates and long furrows (p.79). The irrigation system was a supply rather than a demand system. The report concludes, to establish a demand system is "either organizationally impossible […] or the capital cost of installing such a system would be prohibitive" (p.83). Nevertheless, in 1997 water tariffs were introduced for agricultural water users. The water charge is supposed to be calculated per cubic meter, but because the infrastructure was built for large scale collective farms and not for small private farms, water distribution is estimated rather than measured by cubic meter. Only since 2003 farmers can become legal members of WUAs.

Even though the situation in the irrigation sector in Kazakhstan did not look promising in legal and organizational terms, the South Kazakhstan province bordering Uzbekistan has received special attention in the creation and establishment of WUAs since independence. In this province alone there are 80 WUAs, of which 27 are located in areas which are covered by rehabilitation projects of the World Bank and Asian Development Bank. This seems to suggest that the WUAs in the region had special support and follow international blueprints on organizational structures of WUAs. However, do these blueprints address sufficiently the question of equity and accountability of the WUA to its members.

ARE WUAS ACCOUNTABLE, AND TO WHAT EXTENT? IS IT A MYTH?

Accountability is defined as "the means by which individuals and organizations report to a recognized authority (or authorities) and are held responsible for their actions" (Edwards and Hulme, 1996 p.967). In the case of a WUA, it is reasoned that the staff is doubly accountable to the members through both electoral and financial channels. Current international recommendation is to separate the governing body and management body. Hence there is an electoral accountability channel to the governing body and a financial accountability channel to the management body. While internationally an egalitarian perspective of equity is recommended, by which each member has the same right and voting power, an IWMI/SICWC manual (2003) on how to establish WUAs in Central Asia recommends a proportional perspective, by which membership rights to vote in the WUA are connected to land size (p. 22). This proportional perspective on equity institutionalizes the inequity on the local level. One of the consequences could be that the weight of complain of a small holders counts less.

It is still assumed that financially autonomous irrigation agencies, such as WUAs, provide better services, because WUAs are created to serve the interests of their members and non-members. The obligation of the members and non-members in a WUA is the prompt payment of water service fees (Hodgson 2003, Salman 1997). If members or non-members do not pay their fees or take more water, it is reasoned that gradual sanctions, starting with small fines, can be imposed (Ostrom 1990). In addition, if members or non-members damage the infrastructure they would have to compensate the organization for the destruction.

On the other hand, what happens if the organization fails to provide the water service, either partially or completely? Ul Hassan and Nizamedinkhodjaeva (without date) argue that "if the quality and quantity of the service falls below the agreed standards, the users can, for example, hold part of the service fee payment as a fine." (p.7) Taking into consideration that the service fee could be below the incurred losses, (in most cases this would be the case) then this option does not seem to be satisfying for the members. Instead of making the WUA accountable for not effectively controlling and therefore not being able to provide the service according to the contract, the standard recommendation is to create a dispute settlement committee within the governing body of the WUA. Even though the water rights and water charges are supposed to minimize inter-personal conflicts, the WUA turns again to its users, to let them find an agreement by themselves. Hence, disputes are not minimized, but they are only given a formal space. However, would a small landholder accuse a large landholder and press for compensation? Therefore subjecting him/herself to face repercussions on issues which are not related to water, such as having access to formal or informal credits, to other inputs or outputs, or risk loss of employment possibilities for him/herself or a family member? The blue print ignores the heterogeneity of the WUA members and their embedded status in a wider social and economic context.

ARE THE WUAS IN SOUTH KAZAKHSTAN ACCOUNTABLE TO THEIR MEMBERS?

Recent reports on WUAs in South Kazakhstan have emphasized that local authorities and senior officers of the former collective farms have hijacked the newly established WUAs. (Zimina 2003, Mott McDonald/DfID report 2003). This would imply that the WUA managers would not necessarily represent the interests of the farmers, but the interests of those at higher levels, or have their own benefit in mind. To substantiate the issue of non-accountability of WUAs to its members, data from Makhtaaral and Turkestan district in South Kazakhstan is presented.

While in Turkestan district farmers could not elect the WUA heads, in Maktaraal district the WUA heads were elected by the WUA members. However, in Maktaraal farmers in the WUA K23 complained that they were not able to reelect a new head and that only the district administration could dismiss the current head. Neither in the Turkestan nor in the Maktaraal district was a separation between the governing and managing bodies. Even though, in Maktaraal district international projects provided training on the blue print of WUA organizational structures.

In both districts farmers in complained that the staff of the WUA was only interested in fee collection. These complaints were even raised by the District Water Department in Maktaraal. Farmers complained that the system of water tariffs was not transparent. In different interviews with farmers in the K26 WUA, it became evident that the fees even vary within the same WUA. A farmer of the WUA K23 stated the "WUA staff does not do anything, just takes money. We do not ask what they do with it, we just give it". Similar complaints were raised in Turkestan district.

In all visited WUAs was evidence of tampering with the irrigation infrastructure. While in WUA K23 a farmer admitted that he broke a large piece out of the irrigation channel, in K26 the farmer complained that his outlets were blocked by a tail-end farmer. According to the interviewee, the farmer at the end of the channel was the former governor of Maktaraal district, who had 120 ha agricultural land. The interviewee stated that the large farmer pays a higher price for water and therefore receives all the water he needs. Hence, the farmer implied that the WUA staff blocked some of his off- takes, or accepted that his off-takes got blocked, so that the rich farmer could receive the water. The farmer himself, did not make any attempt at unblocking the off-takes himself, and did not feel that he could complain to the WUA.

In Turekstan district the water situation was aggravated by farmers changing to more water intensive crops. In the Solnak village, during the period of the collective farm the main crops were grass, corn and grain, while today farmers plant cotton. As consequence the water demand of the district has increased, while the district water allocation continued (Solnak village governor). Farmers at the head and tail-end complained that they did not get enough water and that they do not get the water in time. A tail-end farmer complained that "even if I pay additional money for water, it does not mean that I will get the water in time. Maybe I will get the water with the next turn, maybe in the next season or the water department can pay the money back." In one case a farmer received 3 out of 4 irrigation turns. At the time of the fourth turn, the WUA could not provide any water and therefore could not fulfill their side of the contract. The farmer lost his harvest and the WUA paid back the irrigation fee. The fee is quite low and paying back the fee did not prevent the farmer from going bankrupt. In the case where the WUA would have provided the water within the next turn the crops would have received the water too late and it would have had a negative effect on the production. In either case, the WUA did not fulfill the contract and did not take full responsibility for their mismanagement.

CONCLUSION

The case study of South Kazakhstan demonstrated the negative consequences of a rapid and ill planned withdrawal of the state and the consequences of weak blueprints.

The presented cases of the WUAs in South Kazakhstan show that the created WUAs did not represent the interest of their members, but seem to utilize the WUA to generate income. In this sense the WUAs reflected more the interests of individual power holders and the WUA staff and not the whole farmer community. Either the former hierarchical structure or a high level of heterogeneity amongst the members seem to stabilize the system and make individual WUA members accept the situation. That farmers still pay fees could be related to two issues, first that the WUA staff has enough authority to enforce fee payment and second that the fee is low and therefore is minimal in relation to the total cost of farming. Hence, to pay fees could be seen as a formal obligation but which does not guarantee (sufficient) water delivery.

The blue print of WUAs has shown significant weaknesses in terms of accountability. The question is, are these kinds of "accountability" mechanisms in a WUA sufficient, when the livelihood of a farmer depends on it? When participants of the WUA have to compensate for damages, but the WUA itself does not? This raises the question whether one has to understand the WUA as an accountable service provider or a facilitator? In case a WUA should be a service provider with meaningful contracts on water delivery, what could be a solution? To be fully accountable not a conflict committee is necessary but the WUA should compensate for its failure to deliver the service it contractually agreed upon.

REFERENCES

1. Bucknall, J., I. Klytchnikova, J. Lampietti, M. Lundell, M. Scatasta, M. Thurman. 2001. Irrigation in Central Asia: where to rehabilitate and why. World Bank Group. Washington.
2. Edwards, M. and D. Hulme. 1996. Too close for comfort? The impact of official aid on nongovernmental organizations. World Development. 24(6): 961-973.
3. Hodgson, S. 2003.Legislation on water users' organizations: a comparative analysis. FAO Legislative Study 79.
4. IWMI/SICWC. 2003. How to establish a WUA: practical steps for social mobilizers. Tashkent. http://www.iwmi.cgiar.org/centralasiawaterusers/files/pdf/WUA_eng.pdf
5. Mott MacDonald / Department for International Development (DfID). 2003. Privatisation/Transfer of Irrigation Management in Central Asia. Final Report
6. Ostrom, E. 1990. Governing the commons – the evolution of institutions for collective action. Cambridge. Cambridge University Press
7. Salman, S.M.A. 1997. The Legal Framework for Water Users' Associations: a comparative study. World Bank Technical Paper 360
8. TACIS. 1995. WARMAP project report IV: irrigated crop production system.
9. Ul Hassan, M. and N. Nizamedinkhodjaeva no date. Social Mobilization and Institutional Development Approach and Strategy. IWMI Tashkent. http://www.iwmi.cgiar.org/centralasiawaterusers/files/pdf/SMID_StrategyEng.pdf
10. Zimina, L. 2003. Developing water management in South Kazakhstan. in S. O'Hara (ed). Drop by drop: water management in the southern Caucasus and Central Asia. LGI Fellowship Series. Budapest.

WAYS FORWARD TO USE GROUNDWATER BY SMALL AND MARGINAL FARMERS'

(EXPERIENCE, LESSONS AND OPPORTUNITIES)

A. K. Sikka[1], A. K. Singh[2]

ABSTRACT

Surface irrigation systems in terms of major and medium canals are spread allover. However, it has been debated that the unreliability of these systems in terms of adequacy and timings, affects severely to small and marginal farmers. On the other hand irrigation water from ground water is one of the most assured source on which one can rely. Considering the constraints such as small and fragmented land holdings, poor socio-economic conditions etc. restricts the groundwater use to enhance land productivity and ultimately any improvement in their livelihood. It has been always observed that whenever small/marginal farmers have got opportunities to invest quality inputs timely it directly results into enhanced productivity in comparison to medium and large farmers. Countries like India comprises of a large number of small and marginal farmers who are suffering by these constraints. One of the best solutions in this case has been experienced in India by encouraging small and marginal farmers to go for community tube wells. This has paid rich dividends in those areas which need to be widened in a sustainable manner to other areas also after understanding the experiences and lessons of existing arrangements.

This paper tries to discuss some of the case studies where the concept of community tube well has been introduced and based on their experiences and lessons what could be the better opportunities that exists.

INTRODUCTION

Rapid growth of population and industrialization are becoming major threat to agriculture sector as share of land and water decreasing day by day. On the other hand with decreasing investments and declining performance of many large and medium scale surface irrigation systems, interest has been developing in recent years for seeking new ways to improve land productivity and livelihoods of small and marginal farmers at global level. Considering the majority of the small and marginal farmers in developing countries, it is now very well realized that they can be key players in increasing global

1 - Director, ICAR research Complex for Eastern Region, WALMI Campus Phulwari Sharif, Patna – 801505, Bihar, India, Email: aloksikka@yahoo.co.in

2- Senior Scientist (Soil Water Engineering), ICAR research Complex for Eastern Region, WALMI Campus Phulwari Sharif, Patna – 801505, Bihar, India, Email: atulsinghk@yahoo.com

agricultural production and achieving food security. Water being one of the key input in crop production system, it has been observed that access of irrigation water is negligible if we talk about large and medium surface irrigation systems and faces financial constraints in case of groundwater exploration. This requires a major shuffle in existing irrigation strategies in a way that access of irrigation in crop production to small and marginal farmers may be made easy by keeping this commodity at the outset rather than trying to figure out how they can be incorporated in scheme of things.

Besides achievement of green revolution and plenty of successful innovations in agriculture production system, smallholders live at or below the poverty level and are highly averse to risk; their very livelihoods are focused on keeping the margin for error as small as possible. (Pant N., 2004) At the same time they are considered to be capable of managing technologies efficiently provided they have access to affordable technologies that are easy to operate, maintain and repair. Small-scale systems and technologies are attractive since they put the operation, maintenance and management of systems directly in the hands of the individual farmers, thus eliminating any need for centralized control or management. Hence, small marginal holders can be more productive with their yields and efficient utilization of resources in comparison to their counterparts' i.e. medium and large farmers.

Considering the case of efficient application methods of irrigation water unfortunately, most existing modern irrigation techniques do not fit the plots of smallholders, and are far too expensive (in terms of capital or operational costs) to be affordable which hampers their agricultural yield substantially. These constraints forces most of the farming community to stick with the surface methods of irrigation though a range of efficient water application technologies, techniques and practices have been developed over the years on behalf of smallholders. However, many, if not most, technologies have been unsuccessful in their performance, application, dissemination or adoption. Attempts have been undertake to encourage farmers to adopt bush pumps, rope-and-washer pumps, rower pumps, treadle pumps, pitcher pot systems, drag-hose sprinklers, hydraulic ram pumps, microirrigation systems, windmills, water harvesting techniques and a host of other technologies with mixed success. While it may be that some of the technologies simply did not perform to expectations, there is a natural tendency to over-emphasize the technology itself rather than pay attention to the process by which it is identified, modified, and disseminated. All too frequently the end customer -- the farmer – has been left out of the process altogether. As a result uptake of most appropriate irrigation technologies by small-scale farmers has been relatively poor.

The post independence era after 1947 in India, saw greater importance to irrigation and the efforts undertaken resulted in achieving self sufficiency to feed the country's population i.e. most famed "Green Revolution" in late sixties and seventies. After independence the total planned expenditure of nearly 10 per cent of the country was for development of water resources. This comprises of erection of large dams which were considered as "modern temples" of developing India, various major, medium and small surface irrigation systems and development of groundwater resources with the help of deep and shallow tube wells. As per records the irrigated area expanded from 22.6 million hectares in fifties to 59 million hectares in nineties, an increase of 161 percent in four decades. This increase was about 33 percent of the estimated potential. Roughly 42 percent of the net irrigated area in 1990 was from surface water sources whilst 51% was contributed from tanks, step wells, tube and other sources. Considering the trend of source wise irrigated area it can be observed that in recent past decades there is a decline in case of canals from 38.49 % (1970-71) to 30.21 % (1998-99) whereas ground water exploration from tube wells as source of irrigation has increased significantly from 14.34% (1970-71) to 35.63% (1998-99) (Anonymous. 2004). This trend is indicative of diversion of farming community towards reliable source of irrigation water reason being low project efficiencies, which is of the tune of only 40% or less which reflects poor management of surface irrigation systems. Though the use of groundwater has increased significantly (Ballabh et.al., 2003) but still small and marginal farmers are struggling to take advantage of this. Some of the major reasons: poor socio-economic status, small and fragmented land holding sizes, lacking technical know-how, little or no awareness of promotional schemes for installation of tube wells by GOs, poor state of electrification etc.

Considering these aspects this paper, discusses the Vaishali district of Bihar state in India where a participatory approach has been adopted in form of Community Tubewell to provide opportunity even to small and marginal farmers in the area to have easy access of groundwater for irrigation uses. The views and elaboration further by authors are based on personal visit and interactions with concerned agencies and farming community involve and some basic information from secondary sources.

CASE STUDY: COMMUNITY TUBE WELLS IN VAISHALI

FORMATION OF VASFA AND ITS INSTITUTIONAL ARRANGEMENT

Vaishali falls in the northern part of Bihar having rich historical background. Agriculture is the mainstay of the economy a very high percentage 86.4 per cent of the working population is engaged in the agricultural sector (1971 Census) as compared to 82.7 per cent in Bihar, and 69.7 per cent all India. The average size holding is small and fragmented. With respect to the availability of the Vaishali have rich reserve of ground water. According to the Geo-hydrological map of India, Vaishali falls in the high-yield region of unconsolidated alluvium. These formations are richest in ground water and are very congenial to tubewell technology, which can exploit water held in sandy aquifers only, and not in water bearing strata found in rock formations or consolidated formations.

The late J C Mathur of the Indian Civil Service (ICS) was the brain behind the community tubewell. He started his career as the Sub-Divisional Officer, Vaishali, in the 30's and was very much struck by the rich cultural heritage and poor economic conditions of the people of Vaishali region. During the late sixties, he was working as Additional Secretary in the Ministry of Agriculture and was closely associated with India Committee under the Freedom from Hunger Campaign. This provided the platform to do something for the poor farmers of Vaishali. He, therefore, prepared a detailed project report for the development of small farmers of the region and contacted Dewan for the execution of his scheme. Mathur offered Mr. K. D. Dewan the opportunity to settle at Vaishali and serve the cause of small farmers. Mr. Dewan a graduate in Agriculture had come to India after partition and settled down as a farmer in Nelokhedi near Karnal in Haryana. He had tremendous interest in social works and had done some commendable work in organizing farmers' co-operatives in that area. Mr. Dewan was impressed by Mathur's ideas and came to live in Vaishali in 1969 (Prassad

K., 2000). He mobilized the farmers in the area and was successful in forming Vaishali Area Small Farmers' Association (VASFA), which got registered as a voluntary organization in 1971. VASFA was recognized as the first pilot project of its kind in the country by the committee under Freedom from Hunger Campaign. It received a grant of Rs.4,00,000 from the government of Norway. Out of it, Rs.2,00,000 were kept in fixed deposit in the loaning bank (Central Bank of India) as security, and other half is used as a revolving fund for the developmental works of VASFA, particularly for construction of tubewells. The main objective of VASFA was to organize small farmers for multifarious agricultural activities, and to manage loans for group tubewells, agricultural machines, godowns, and plant protection apparatus etc. It worked in collaboration with People's Action for Development India (PADI), Ministry of Agriculture, Government of India and Central Bank of India. The association was divided into three zones – viz, Vaishali, Madarna and Bibipur. The executive committee of VASFA consisted of a President and three Vice-Presidents (representing three zones) elected by all members for one year and three years, respectively, a Treasurer, who is a representative of PADI, and a General Secretary who is nominated for six years jointly by PADI and 'Vaishali Sangh' (Vaishali Sangh was a voluntary organization, aiming at cultural and economic development of Vaishali region formed in the early forties with the effort of late Mr. J C Mathur when he was serving as commissioner at Muzaffarpur). Mr. Deewan worked with VASFA as a PADI employee for seven years, but resigned in 1978 as a PADI official and was associated with VASFA as its General Secretary since then. Upto 1983 VASFA managed to organize 36 community tubewell groups (16 in Vaishali, 7 in Madarana and 13 groups in Bibipur) in 16 villages of Vaishali and Muzaffarpur district of Bihar, covering a membership of 650.

INSTALLATION OF COMMUNITY TUBEWELL

In the area surrounded for the community tubewell work, the officials of INADP (Indo-Norwegian Agricultural Development Project) and VASFA approach the small and marginal farmers and persuade them to obtain the benefits of a joint tubewell. The first step in this direction is the formation of groups of small and marginal farmers. Generally farmers having land over 5 acres are not included. However, sometimes their inclusion is unavoidable, on account of the location of their land. The members of the group should have contiguous land so that it could be commanded by a joint tubewell. One of the member-farmers in each group has to donate 0.02 acres of the land for installation of the tubewell. The group members elect one of them as group leader. Each farmer furnishes a copy of the official record of the total land owned by him and enters in an agreement to abide by the terms and conditions set by VASFA and INADP (Indo-Norwegian Agricultural Development Project). The papers are then submitted to the loaning bank (Central Bank of India), and the necessary amount is withdrawn from the revolving fund for the construction of the tubewell cabin, installation of pump set, energisation, and construction of field channels. After the completion of these works, the total cost is distributed among the group members in proportion to the area of their land under the tubewell command. The members at this stage enter into a direct agreement with the bank, according to which the amount is treated as a term loan borrowed by the individual farmer from the bank. Each farmer is required to pay his loan with interest in five years in six-monthly installments. There is also a provision to recover the loan from one-tenth of the crop of the farmers.

MANAGEMENT OF COMMUNITY TUBEWELLS

The management of each tube well was the joint responsibility of group farmers and the group leader. The water charges for members and non-members were fixed different. Initially most of the community tubewell had electricity motor but with non-availability and irregular supply of electricity nearly all the tubewell changed to diesel operated engines. Presently, the charges for members are Rs. 9/hr plus diesel and for non-members it is Rs. 18/hr plus diesel. The members who want to irrigate their lands which are outside the demarcated command area initially are charged as non-member. In regard with the water distribution of water, members are preferred first then non-members. For giving water, the time duration is allocated to members in proportion to their land. Sometimes the time duration is fixed on a weekly basis, at other times it is decided by mutual agreement and convenience of the group members.

The method for collecting the water charges, in majority of the cases it has been observed that, members pay after the crop selling/crop maturation, and the non-members pay either on a monthly basis or at the time of taking the water. Sometimes the members also pay on a monthly basis.

Conflicts did arise in some cases, either over the distribution of water, caused generally because of electric failures and rostering of electricity/scarcity of diesel, or over the operation and maintenance of the tubewell and upkeep of field channels etc but it was reported that conflicts are resolved in the groups somehow. The most common method used for resolution of conflicts is to call a group meeting and thrash out the problem to a workable solution. The second most common method is to involve the VASFA and INADP officials in the meetings and thirdly a particular member can be warned for cancellation of his membership by the rest of the members.

PROBLEMS AND PROSPECTS

Some of the major problems associated in smooth working of community tubewells have been short supply of electricity, either due to electric failure or because of rostering of electric supply, acute shortage of diesel during the peak season, timely maintenance of mechanical defects in the tubewells, non-payment dues in time by the farmers in some cases, lack in maintenance of proper records and accounts on irrigation, initially when groups were formed some influential farmers also came in groups they managed to get the tubewells installed in their land and also became group leaders and create problems committing all kinds of irregularities and trying to deprive the other group members of the association, in few places caste barriers came into picture where high caste and low caste people had reservation in working together.

Timely recovery of bank loan does became a common problem as recovery of loan was not stressed in the initial stages this was to give farmers ample time to maximize their agricultural production and to repay the loan when they become prosperous. However, this initial complacency has made the farmer indulgent, non-appreciative of the role of the bank. In this way the loan were treated as a free gift in some cases, and does not care to repay it.

IMPACT OF COMMUNITY TUBEWELLS

Besides these problems as stated above community tube wells have done good job to bring wider group of farming community to work together. Specially incase of resource poor farmers who are not able to enjoy the benefit of owning a tube well. In this way the movement started by VASFA and INADP have not only helped small and marginal farmers to get access to irrigation water but have also helped these farmers get individual bank loans for meeting their various other agricultural requirements or provide them a subsidiary source of income – i.e., diary development etc. The poor farmers are thus helped to get rid of the clutches of money-lenders. Considering one of the major concerns of the policy makers in recent years which have been to percolate the benefits of the various schemes to the rural poor judging from this angle, the experiment of community tube wells in Vaishali has been extremely successful.

CONCLUSION

On the basis of out study it can be recommended that community tube wells are bound to be successful subject to proper kind of leadership/awareness campaign & technical know-how is facilitated amongst wider group of farming community besides taking care of formation of tube well groups. This attempt also facilitate conjunctive use of rain, ground and surface water besides bringing improvement in the local environment which directly or indirectly helps the livelihood of the people in the area through increased yield, better health, employment opportunity etc. At other hand on social front this attempt brings different set (based on holding sizes and caste) of rural community together.

REFERENCES

1. Anonymous. 2004. Agricultural Statistics at a Glance. 2004. Accessed on internet at http://agricoop.nic.in/Agristatistics.htm on 21/12/2006.
2. Ballabh Vishwa and Kameshwar Choudhary. 2003. Groundwater and Agriculture Production: A Comparative Study of Eastern UP, Bihar and West Bengal', IWMI-TATA Water Policy Programme, Anand.
3. Prassad Kamta. 2000. Study on status, impact and determinants of farmers' participation in irrigation management. Sponsored by Planning Commission Gov. of India. Institute for Resource Management and Economic development Delhi – 110092. Published on Nov. 2000. Accessed on internet at http:// planningcommission.nic.in/reports/sereport/ser/irmed/irm_cont.pdf on 21st Dec. 2006.
4. Pant Niranjan. 2004. Trends in Groundwater Irrigation in Eastern and Western UP. Paper published in Economic and Political Weekly July 31, 2004. Accessed on net on 16/12/2006 at http://www.iwmi.cgiar.org/iwmi-tata/files/pdf/EPW/EPW02.pdf.

PARTICIPATORY IRRIGATION POLICY UNDER THE INDONESIAN WATER RESOURCES LAW

Soeprapto Budisantoso[1]

ABSTRACT

Indonesian Water Resources Law issued in 2004 provide a benchmark for water resources management and development, and therefore for irrigation, policy in Indonesia. The irrigation sector affects the livelihood of Indonesian farmers, and influence nation's food production. In accordance to the law, irrigation management be held by the government, and irrigation service fee is free within the government's built and operated irrigation systems.

However, due to limited government's financial, material, and human resources, farmers and other beneficiaries participation in term of contribution is encouraged. The law also determines local government participation, in term of obligation, to share government's responsibility on the base of administration boundary and the areas of irrigation systems.

This policy was a form of adjustment to former policy on Irrigation issued in 2001, in which irrigation management to be handed over to farmers, and irrigation service fee is an obligation collected by farmers to finance the purpose, and government's participation, in term of contribution, is encouraged to help farmers. However, under the new participation policy, farmers may be assigned to manage the irrigation system on behalf of the government, on condition that farmers are capable and willing to contribute 50 percent of management cost of the proposed system.

Keywords: PIM, Indonesian Water Law, Irrigation

1- Former Head of Utilities Management Service, Water Resources Management Services, South Sulawesi Province, Republic of Indonesia, Jl. AP Petta Rani no 88, Makassar, 90222.
Phone: 62-411-440322, Fax: 62-411-458438, email: o816254353@yahoo.com.

INTRODUCTION

1.A. IRRIGATION DEVELOPMENT AND MANAGEMENT

Indonesian Water Resources Law issued in 2004 (Law No 7/2004) determine policy and strategy related to irrigation development and management in Indonesia. It is because of irrigation affects the livelihood of many low income Indonesian farmers and the country food production, according to the law, the irrigation development and management is under the government authority and responsibility. However, due to the decentralization and participation policy aiming at sustainable irrigation management, the law distributes the authority, and therefore responsibility, of irrigation development and management to the regional governments (provinces and districts/municipalities) and also to the beneficiaries (farmers). The delineation of the responsibility is as tabulated in Table 1. The foregoing table shows the necessity of support by other stakeholders to perform the development and management, indicates the participatory policy of irrigation development and management of the Republic of Indonesia. The standard of government built irrigation system is shown in a schematic diagram as in **Figure 1.**

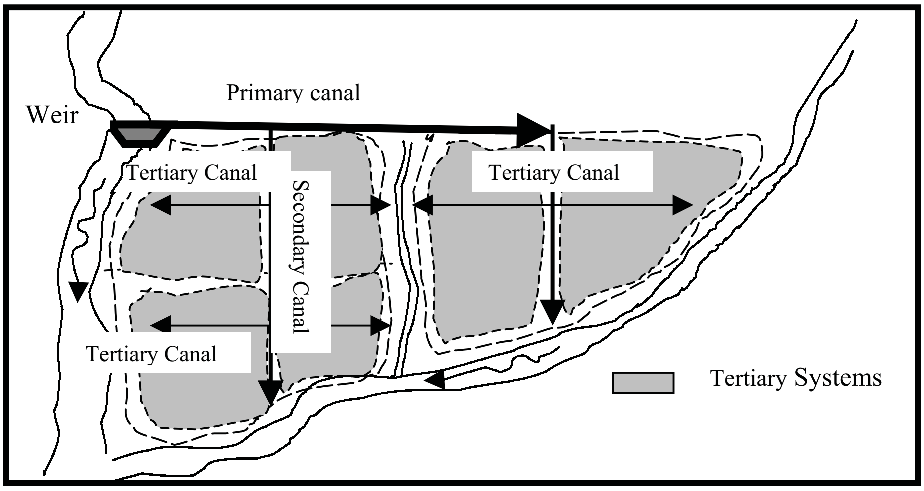


Figure 1. Schematic Diagram of Indonesian Irrigation System Lay Out

Table 1. Policy and strategy of Indonesian Irrigation Development and Management under Water Resources Law No 7/2004

Program	Activity	Category of the systems	Responsibility by (obligation)	Supported by (contribution)
Government financed Irrigation Development	Upgrading and Construction of New and Expansion of Primary and Secondary Irrigation Canals	Within the district/ Municipality	District/Municipality Government	Farmers, Provincial, and Central Government
		Inter-district Irrigation Systems	Provincial Government	Farmers, District, and Central Government
		Inter-province Irrigation Systems	Central Government	Farmers, District and Provincial Government
Government financed Irrigation Management	Operation, Maintenance, and Rehabilitation of Primary and Secondary Irrigation Canals	Within the district/ municipality Less than 1,000 ha	District/Municipality Government	Farmers, Provincial, and Central Government
		Inter-district and 1,000 – 3,000 ha Irrigation Systems	Provincial Government	Farmers, District, and Central Government
		Inter-province and over 3,000 ha Irrigation Systems	Central Government	Farmers, District and Provincial Government
Irrigation Development and Management	Tertiary System within Government financed Irrigation System	Structural Development	Government	Farmers
		Canal Development and System OM	Farmers	Government
	Primary, Secondary, and Tertiary within the private/village financed irrigation system		Private/Village	

1.B. PARTICIPATORY IRRIGATION DEVELOPMENT AND MANAGEMENT.

The participatory irrigation development and management, is defined as participation of beneficiaries and other stakeholders in the whole process of development and management not limited in the planning and decision making process but also in financing, implementing, and providing other resources as inputs to the irrigation development and management, in terms of obligation as well as contribution.

Under the foregoing policy and strategy, the institutional development, empowerment, and capacity building of the stakeholders to be reached by the following activities:

1. Incorporation of the stakeholders in the planning , design, and implementation of irrigation development (construction and upgrading) and management (operation, maintenance, and rehabilitation),

2. Participation in financing and providing resources, as obligation as well as contribution, in construction, operation and maintenance. In case of farmer's participation, it is as obligation in the tertiary systems and as contribution in primary and secondary systems.
3. Provision or assistance of organizational and institutional assets such as office space and equipment, transportation facilities, and production facilities, i.e., from central government to regional government, or from government to farmers.

IRRIGATION DEVELOPMENT AND MANAGEMENT IN INDONESIA

1.C. The objectives: The main objective of irrigation development and management is to support the agricultural development aims to increase the income and welfare of the rural population, farmers in particular. Improvement of farmer's income by increasing the agricultural production will reduce number of rural population under poverty line (37.3 million, 2003), improve welfare, and increase agricultural sector contribution to the GDP. The 2003 data show number of land owner farmers engaged in rice cultivation is 17.56 million household with average land ownership size of paddy field is 0.44 Ha/household. The income per capita of the country is IDR 7.1 million (721 USD). Agricultural sector, together with forestry and fishery, contribute 16.6.% of the Gross Domestic Product (GDP), while mining and quarrying sector contribute 10.7 %, trading, hotels, and restaurant 16.3 %, industries and manufactures 24.6 % and others sectors 31.8 %.

Another purpose of agricultural development supported by irrigation is securing food availability for the increasing population of the country. Total number of Indonesian population by the year of 2003 is approximately 215 million and the latest population growth rate is 1.5 % per year. Indonesian mainly consumes rice, which contributes to supply 67% of calories and 64 % of proteins per capita per year. In 2003, total production of paddy is 56 million ton (dried un-husked paddy). The incremental rate of paddy production is 1.14 % per year. Java Island produces 54.18 % of the total production, with production rate of 5.23 ton/ha. Paddy production is the largest output of food crop, followed by cassava (18.5 million ton), maize (10.9 million ton), peanuts (0.78 million ton) and soybean (0.67 million ton).

It was partly because of the foregoing purpose and condition that under the new Indonesian Water Resources Law, government assume responsibility of irrigation development and management, and therefore, farmers within the government built irrigation system are free from paying the irrigation service fee. The extent of government responsibility and obligation shown in the following Table 2.

Table 2. Classification of Paddy Fields

Condition of Paddy Field	Developped By	Administration	Area (Ha)	Ratio (%)
Irrigated Paddy Fields	Governement	Central	2.206.000	29
		Provincial	1.098.000	14
		District	2.701.000	35
	Village		560.000	7
Rainfed Paddy Fields			1.135.000	15
Total Paddy Fields			7.700.000	100

1.D. FORMER POLICIES ON PARTICIPATORY IRRIGATION

The participatory irrigation development and management factually has been embedded within the traditional culture of the nation. The traditional model varies with the region and ethnic groups, but one of the most famous was Subak System in Island of Bali, in which farmers develop their own "water government" with strong set of democratic laws and guidelines to be observed by its members, connecting the social and cultural obligation with their beliefs and religion. The irrigation systems, categorized as village financed irrigation systems, scale varies from 10 to 800 ha, was built with heavy contents of appropriate technology in the planning of canal lay-out, and in the structural design and construction.

It was in early 1900 when Dutch Administration started to develop large scale irrigation schemes in Indonesia for the benefit of their trading company VOC (Dutch East Indian Company). Then, after the proclamation of independence in 1945, the irrigation development was escalated under the Indonesian New Order Government started in 1966. The development, with top down approach and the spirit of government build everything, subsided beneficiaries participation. The tertiary irrigation system development which had been the responsibility of farmers was taken over by the government. Under the situation where farmers' participation was neglected, farmers became passive, powerless, yet demanding, which in turn became the cause of difficulties in operation and maintenance and high cost in government expenditures in irrigation.

Realizing the future difficulties when farmer's participation in irrigation development and management was diminishing, Indonesian Government, in cooperation with various donor countries such as Japan (JICA and JIBIC), USAID, World Bank, ADB, GON, etc, started to plan and implement various models of institutional development, empowerment, and capacity building, in promoting farmers and beneficiary's participation. It was started in early 1980's when irrigation design team was not only consisting of engineers and economist, but also sociologist and anthropologist studying the existing and the required farmers and stakeholders institutions and improving farmers' capacity and participation in the irrigation development. In assisting the study team speaking to farmers and implementing the socio-engineering prepared by the team, the service of NGO became necessary.

Under the centralized New Order Government (1965-1998), it was formulated that Central Government develop the irrigation system, while Regional and Local

Government conduct the irrigation management, i.e., operation maintenance and small rehabilitation, under Central Government inappropriate financial support. The beneficiaries participation was developed by beneficiaries pay principle in which farmers, organized in Water Users Association (WUA), were to pay the government collected irrigation service fee (ISF) to gradually reduce government burden on providing cost of irrigation management. In general the ISF collection rate was small. Moreover, although in some regions the ISF collection rate is appropriately high, the outcome was not satisfactory for the regional government used the collected ISF for purposes other than irrigation management. As a result Central Government burden on irrigation management cost were remain high, irrigation system maintenance were inadequate and suffer from serious degradation, and farmers were reluctantly pay for the ISF.

When the decentralization law was enacted to promote local government participation, irrigation management was placed under the responsibility of local government. Because of the limited local government budget capacity, local government collected ISF became the backbone to support of the irrigation management cost. However, because of reasons discussed in the foregoing paragraphs, collection of ISF was inadequate, and irrigation system degradation was increasing.

Under the National Water Resources Policy Reform leading to strengthen private sector involvement supported by World Bank and Asian Development Bank it was concluded that beneficiaries pay and manage policy will be a possible solution to overcome the irrigation management problems. Under the reform, Indonesian Government Regulation on Irrigation issued in 2001 promoted farmers to be the responsible institution for irrigation management, and an irrigation management hand-over from government to farmer's organization meeting the hand-over criteria shall be conducted. The farmers collected ISF, will be the backbone to support the irrigation management cost with government assistance, as government participation in term of contribution.

To support the 2001 Irrigation Management Policy, the following steps was required:

- Formation and revitalization of farmers' Water User Association (WUA) in tertiary systems, federation of water users association (FWUA) in secondary systems, and main water user's organization (MWUA) in primary systems, in a democratic and participative way.
- Formation of Irrigation Commission, stakeholders' forum authorized to determine irrigation plan, policy, and financing within the framework of participatory approach in District Level and Provincial Level, respectively.
- Capacity development and empowerment of the aforementioned institutions by training (organization, administration, operation and maintenance, finance, cooperatives, farming, etc), comparative study, and by provision of appropriate legal status, power, and regulations supporting the institutions, and by provision of technical and financial assistance whenever necessary.

Capacity development and empowerment of the WUA/FWUA/MWUA by incorporation in the planning and design activities, and also in the implementation of irrigation development (construction and upgrading) and hand over the management (operation, maintenance, and rehabilitation) related to the area represented by the farmer groups.

1.E. ADJUSTMENT OF THE 2001 IRRIGATION MANAGEMENT POLICY.

In contrary of the hand over irrigation management policy to the farmers group stipulated in the Government Regulation no 77/ 2001, the Water Resources Law no7/ 2004 stated that irrigation management of primary and secondary system remain under the government responsibility, including the cost responsibility, whereas the farmers group responsible for the management and cost of the tertiary system. The other adjustment is that farmers were not required to pay for the ISF to the government, except for organizational levee in the tertiary system collected by farmers. The policy was verified by the issuance of Government Regulation no 20 in 2006 on Irrigation as a replacement to the former Government Regulation no 77/2001. The purpose of the adjustment was to remove the irrigation management burden from the farmer's shoulders, particularly the financial burden that will possibly become more expensive if the farmers group as private institution holding the irrigation management determines the profitable irrigation service fee. Beneficiaries pay principle was considered inappropriate applied to the farmers since Indonesian farmers were normally poor, considering the land ownership size of only 0.44 ha/farmer household.

However, in promoting the farmers participation particularly in the area where farmers are capable, a ministerial decree was prepared to guide that in addition of farmers shared responsibility in tertiary system irrigation management, farmers were allowed, under their own willing and proposition, to manage on behalf of the responsible government, the secondary and primary systems, on condition that farmers are willing and capable to contribute 50% of the management cost of the system they want to manage.

CONCLUSION

Participation of stakeholders, i.e., regional and local government and farmers group, in irrigation development and management, requires not only incorporation of the stakeholders in the decision making and implementation of the process, but also allocation or mobilization of their input and resources in kind of manpower, materials, equipment and finance, may be in the form of obligation because of the law, and/or in the form of contribution based on their capability and willing. The foregoing steps were obtained through empowerment of the related irrigation development and management institution and Water Users Associations (WUAs).

The on going policy on irrigation management supported by Indonesian Water Resources Law and the new Government Regulation on Irrigation was dedicated to remove the irrigation management burden and cost from farmers shoulder, however when farmers are capable, under farmers willing farmers may conduct the management of the irrigation system on behalf of the responsible government on condition that farmer can afford to contribute 50% of the management cost of the system.

REFFERENCES

1. Government of Indonesia, 2004, Republic of Indonesia's Law No.7 Year 2004 on Water Resources, Directorate of Water Resources and Irrigation, Ministry of National Development/National Planning Agency, The Law, 55, The Explanation, 55, Indonesia.
2. Government of Indonesia, 2001, Government Regulation no.77 on Irrigation, Directorate General of Water Resources, Ministry of Public Works, Indonesia.
3. Government of Indonesia, 2006, Government Regulation no.20 on Irrigation, Directorate General of Water Resources, Ministry of Public Works, Indonesia.
4. Government of Indonesia, 2005, Draft Ministry of Public Work Decree on Participatory Irrigation Management, Directorate General of Water Resources, Ministry of Public Works, Indonesia.

EXPERIENCES OF BULK WATER ALLOCATION IN LARGE SCALE IRRIGATION MANAGEMENT

Mohamed Aheeyar[1]

ABSTRACT

Irrigation Management Turnover (IMT) was introduced in major and medium scale irrigation scheme in Sri Lanka in early 1990s. After over a decade of experiences it has been found that, Water Users Associations (WUAs) have failed to mobilize adequate amount of resources toward system operation and maintenance (O&M) leading to inefficient water use and deterioration of irrigation infrastructure.

The concept of Bulk Water Allocation (BWA) was introduced in 2002 and pilot tested in the Mahaweli System-H to find out a methodology, which can be used as a complete solution for water management problems in large-scale irrigation schemes. Under the BWA quantity of water to be issued for a particular distributary canal (DC) and consequently for a particular user for the cultivation practices in a given season is fixed before commencement of the season. The concept provided the volumetric impression of water use and incentive to utilize the water in an efficient manner.

The research findings show that, water productivity, cropping intensity and extent of cultivation in dry season has increased significantly after implementation of BWA while using less amount of water to cultivate one unit of land has reduced. Farmer perception on BWA is also very positive in terms of increase in productivity and income.

BWA concept has been seen as a strategy to achieve the expected objectives of IMT. Adequate supply of water with reliability and timeliness has improved the farmers' confidence in water issues which has been a great incentive to motivate farmers to shift from traditional high water consuming, low return rice cultivation to less water consumptive, high return cash crops. Decentralized partial O&M cost recovery adopted with BWA has been successful in achieving targeted collection compared to past failed attempts of centralized water charges.

1- Research Associate, Hector Kobbekaduwa Agrarian Research and Training Institute, PO Box 1522 Colombo, Sri Lanka. Email: hartiiar@sltnet.lk, Tel: +94112698539, Fax:+94112692423

1. INTRODUCTION

Allocation of finance for sustainable operation and maintenance (O&M) of irrigation systems has been decreasing over the years due to budgetary and fiscal constraints although irrigation systems have been expanding and improving in Sri Lanka after gaining independence in 1948. Failure to make necessary policy changes to generate and allocate sufficient funds to properly operate and maintain the irrigation systems has been one of the main concerns of policy makers to avert the deterioration of irrigation infrastructure and increase the efficiency of water use in irrigated agriculture in order to meet competing demand for water between different sectors.

Participatory irrigation management (PIM) policy was adopted in major irrigation systems in Sri Lanka in late 1980s as a measure of government cost reduction in operation and maintenance (O&M and improve the performance of the systems. However, after couple of decades of experience in PIM, it has been found that, WUAs have failed to mobilize adequate amount of resources toward O&M, and some of the maintenance responsibilities have become 'no body's' business and there is a serious under investment in irrigation system maintenance (Aheeyar, 1997, Samad and Vermillion, 1999). The situation has lead to not only poor irrigation performances but also deterioration of irrigation infrastructure than expected life period and leading to premature rehabilitation of the entire scheme.

Mahaweli H area is the first of the downstream area benefited by Mahaweli river diversion project. The system H has the longest history of settlement in the country and was relatively highly occupied before the Mahaweli water was diverted. System H contains about 60 percent of irrigable land with well-drained Reddish Brown Earth (RBE) soils, which require more water for the cultivation of low land rice. The total irrigation extent in the system H is around 31,500 ha allocated among equal number of farmers at the rate of one hectare per farmer. The cropping pattern in the system H is generally rice crop for entire extent during wet season and rice and Other Field Crops (OFCs) for 50 percent of total extent during dry season. Therefore annual cropping intensity rarely reaches over 150 percent in system H, which is lowest, compared to other parts of Mahaweli development area. Therefore water management is crucially important in Mahaweli system H for the successful cultivation especially during dry season. At the same time lack of a financial allocation for O&M due to fiscal constraints lead to poor performance of irrigation systems, which aggravated the problem of water scarcity and of proper management of limited available water. Mahaweli Authority of Sri Lanka (MASL) implemented various special water management packages in Mahaweli H area time to time to meet the challenge of water scarcity and to improve the water use efficiency.

The concept of Bulk Water Allocation (BWA) was introduced and pilot tested by Mahaweli Restructuring and Rehabilitation Project (MRRP) in Mahaweli system-H to find out a methodology, which can be used as a complete solution for water management problems in major irrigation schemes (Gunaratna, 2004). Under the BWA, quantity of water to be issued for a particular user and consequently to the distributory canal for cultivation practices in a given season is fixed before commencement of the season. Therefore, particular user has a legal water right and has to actively participate in water management and also provided incentive to save the water. A maintenance fund has been set up at DC level with farmer contribution in order to conduct the self-management of canal system. Under this initiative in Mahaweli System it was expected to develop Mahaweli H to as a 'model demonstration system' in terms of both irrigation management and commercialized agricultural production system. The programme was implemented as a package which included rehabilitation of the system, IMT, allocation of water on pre fixed quantities at each seasons, capacity building of farmers and officials, institutional development and establishment of forward and backward linkages.

The concept was seen as a strategy to achieve the expected objectives of IMT and increases the water use efficiency and water productivity. The project started in 2001 dry season, on pilot basis in selected locations and later it has become a broad subject in Mahaweli H area with the improvements made in subsequent seasons. The other main features of the BWA is farmers have to pay a O&M fee of Rs 250 per ha per season to the respective WUAs which is to be used for the sustainable O&M of the turned over distibutory system. Farmers have to manage the crop with the agreed quota of water and the irrigation agency has the responsibility of supplying the promised amount of water. The failure to supply of agreed quota and consequent crop failure has to be compensated in double by the agency and the demand for additional amount of water by farmers will be charged.

2. OBJECTIVES

The major objective of the study is to assess the impacts of participatory irrigation management adopted through implantation of BWA concept on the performance of water distribution and agricultural production.

3. RESEARCH METHODS

3.1. STUDY SITES

Mahaweli H system is divided into nine blocks for the purpose of administration, in which two blocks were selected randomly for the detailed survey, namely Galnewa and Madatugama blocks. Two WUAs from each block selected randomly to represent head and tail areas of branch canals.

3.2. METHODS OF DATA COLLECTION AND ANALYTICAL FRAMEWORK

The study is based on the information and data collected from literature, secondary data maintained by MASL, key informant interviews, focus group discussions and structured questionnaire survey. Necessary data was also collected from WUAs records.

A multi stage stratified random sampling technique was adopted in selecting sample farmers considering the head and tail differences of the system and the selected canals. The total sample size was 120.

The main quantitative parameters used for the assessment are,

i) Cropping intensity=

$$\frac{\text{Area cultivated in the dry season + Area cultivated in the wet season}}{\text{Cultivable area}} * 100$$

ii) Tank Water duty (m)= $\frac{\text{Actual quantity of irrigation water used } (m^3)}{\text{Actual extent cultivated } (m^2)}$

iii) Land and water productivity

Land productivity is defined as value of output obtained from a unit of cultivated area while water productivity is the value of output received from a unit of irrigation water supplied.

$$\text{Land Productivity (\$/ha)} = \frac{\text{Total Value of Production(\$)}}{\text{Total Cultivated area(ha)}}$$

$$\text{Water Productivity } (\$/m^3) = \frac{\text{Total Value of Production(\$)}}{\text{Diverted Irrigation supply(m3)}}$$

Standard Gross value of Production (SVGP) is used to measure value of production. SVGP is standardized estimates of production calculated using international price of rice (major crop cultivated under irrigated condition).

$$SVGP = \left(\sum A_i Y_i \frac{P_i}{P_b}\right) P_w$$

A_i - Area of crop i

Yi - Yield of crop i

Pi - Price of Crop i

P_b - Price of base crop (Rice)

P_w - Price of base crop traded at world price

4. RESULTS AND DISCUSSIONS

4.1. WATER SUPPLY PERFORMANCE

4.1.1. Gross water quota/ seasonal water duty at block level

Data was analyzed to find out the performance of water duty before vs after BWA in Mahaweli H area. The block level water duty gives an overall idea of the efficiency of the whole system in providing water to save crop needs.

Figure 1 illustrates the trend of tank water duty over the years in dry seasons, indicating the improvement in tank water duty after year 2002. As Mathmaluwa (2003) pointed out, lowering of tank water duty is a combined effect of restricted water quota delivered under BWA, cultivation of low water requiring crops, effective water management under IMT and rehabilitation of irrigation system before turnover.

Performance achieved in water duty is a result of the efficiency in water distribution and in utilization of water at secondary and tertiary level by WUAs and water supply performance in primary canal system by the irrigation agency. Therefore the study analyzes the data of main canal water duties of Mahaweli H to find out the trend of water duty in the main canals, where canal maintenance and water distribution is mainly handed by MASL. The average main canal water duty during dry seasons in the past 5 years prior to the implementation of BWA is 4.85ft, while the average value after BWA is 3.43ft. The main reasons for the lowered main canal water duty are reduced conveyance losses due to rehabilitation of canal system and strict management practices adopted in water supply after BWA as perceived by irrigation officials.

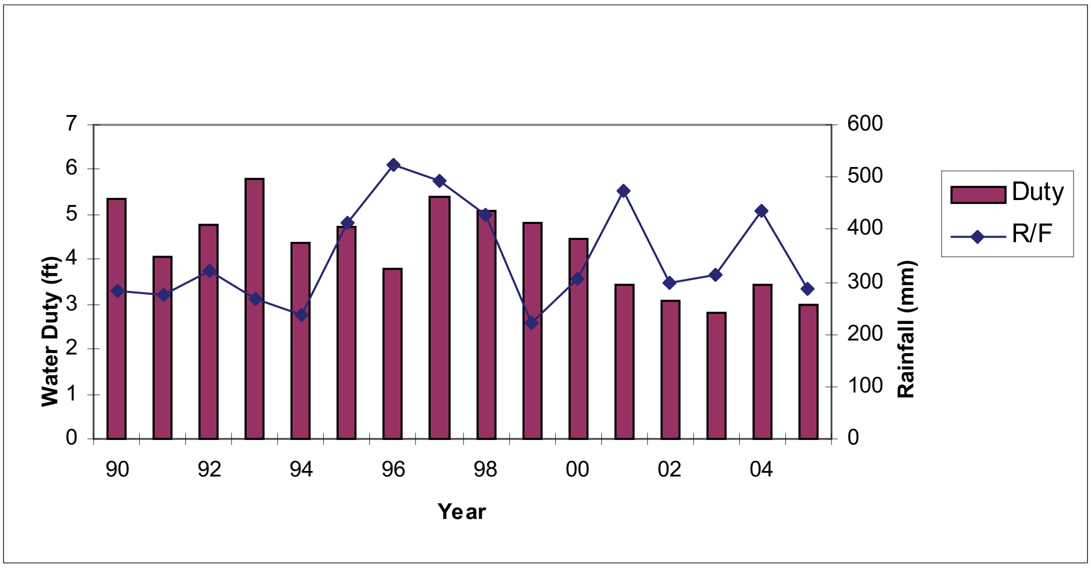


Figure 1. Average water duty in past dry seasons and rainfall pattern

4.1.2. Percentage of land extent cultivated in dry season

Area cultivated during the past dry seasons in Mahaweli H area before BWA was far below than planned extent in Mahaweli development programme and in many years it had been below 50 percent of total cultivable land. However, the extent cultivated in dry seasons after 2002 was over 60 percent of total land and shows an increasing trend except in year 2004 which affected by severe drought prevailed in the country. Figure 2 illustrates the percent of land extent cultivated in past dry seasons. The achieved performances is basically an outcome of the water saving of wet season due to strict water management policies adopted with the implementation of BWA and more farmers shifting to less water consuming crops.

The aim of the BWA programme is to reach 100 percent extent of cultivation in the dry seasons, but it is yet to be realized. The extent cultivated in 2005 dry season has reached to about 93 percent of total extent, which is a remarkable achievement compared to past seasons.

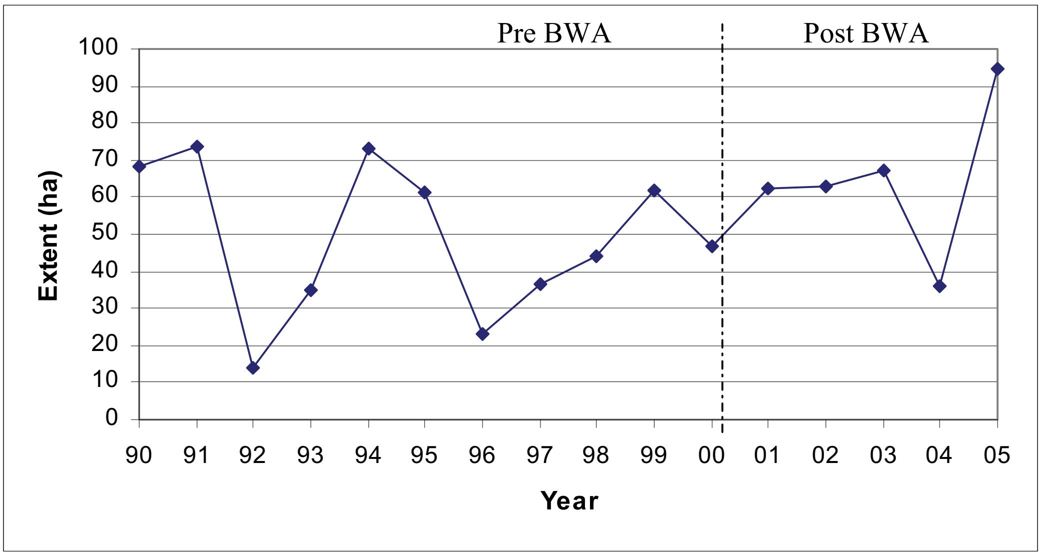


Figure 2. Percentage of land extend cultivated in past dry seasons

4.1.3. Cropping intensity

Annual cropping intensity (CI) for past 10 years of Mahaweli H area was examined to understand the change of CI over the years. The findings are shown in figure 3. The figure indicates the gradual increase of cropping intensity after implementation of BWA in 2002. One of the reasons for the lower CI before 2002 might be deteriorated state of infrastructure prior to rehabilitation. According to farmers and officials higher CI was achieved not only due to rehabilitation of the scheme, but also with cultivating less water consuming crops and efficient use of water in both seasons.

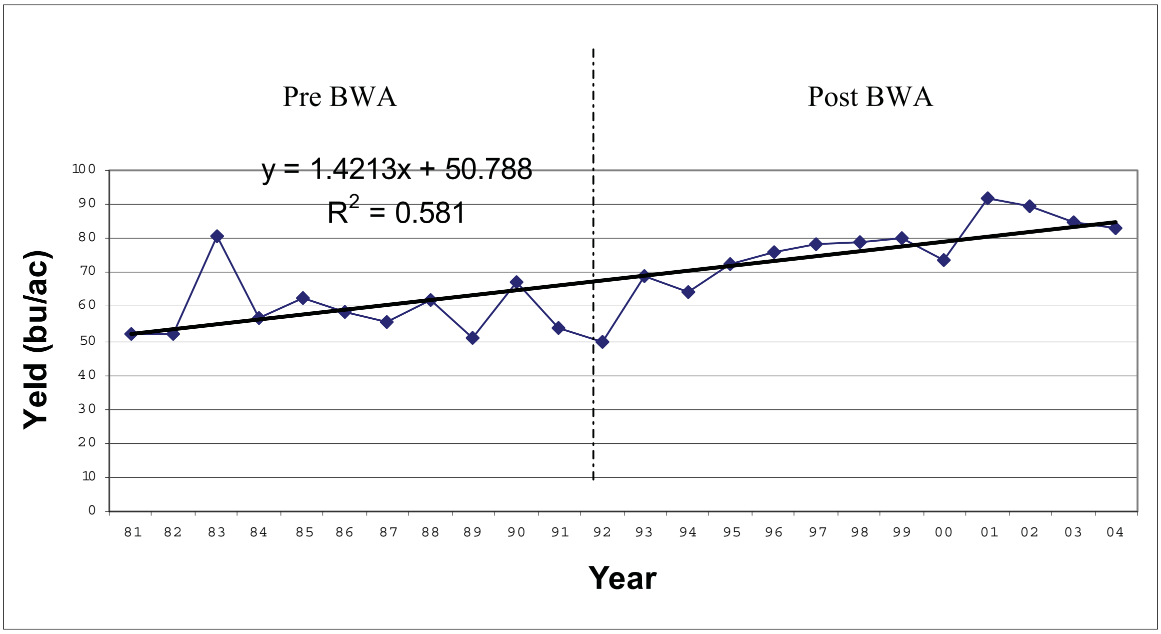


Figure 3. Changes in cropping intensity in Mahaweli H area

4.2. PERFORMANCE OF AGRICULTURAL PRODUCTIVITY

4.2.1. Changes in crop yield

The major crop cultivated in Mahaweli H system is rice both in wet and dry seasons. Therefore, the change in rice yield was observed to understand the trend of yield over the years. The findings are illustrated in figure 4. The figure clearly shows an increase of yield in dry seasons is very prominent after year 2002. The similar results are observed in the wet season yield data too. Though yield is an outcome of multiple factors such as variety improvement, access to extension, use of straw/organic fertilizers and timely cultural practices, the WUA leaders perceived that systematic water management and reliable supply is one of the main reasons for the increase in rice yield in both seasons. According to TEAMS (2003), the yield level was low before BWA programme and some tail end farmers received much lower yield during before BWA.

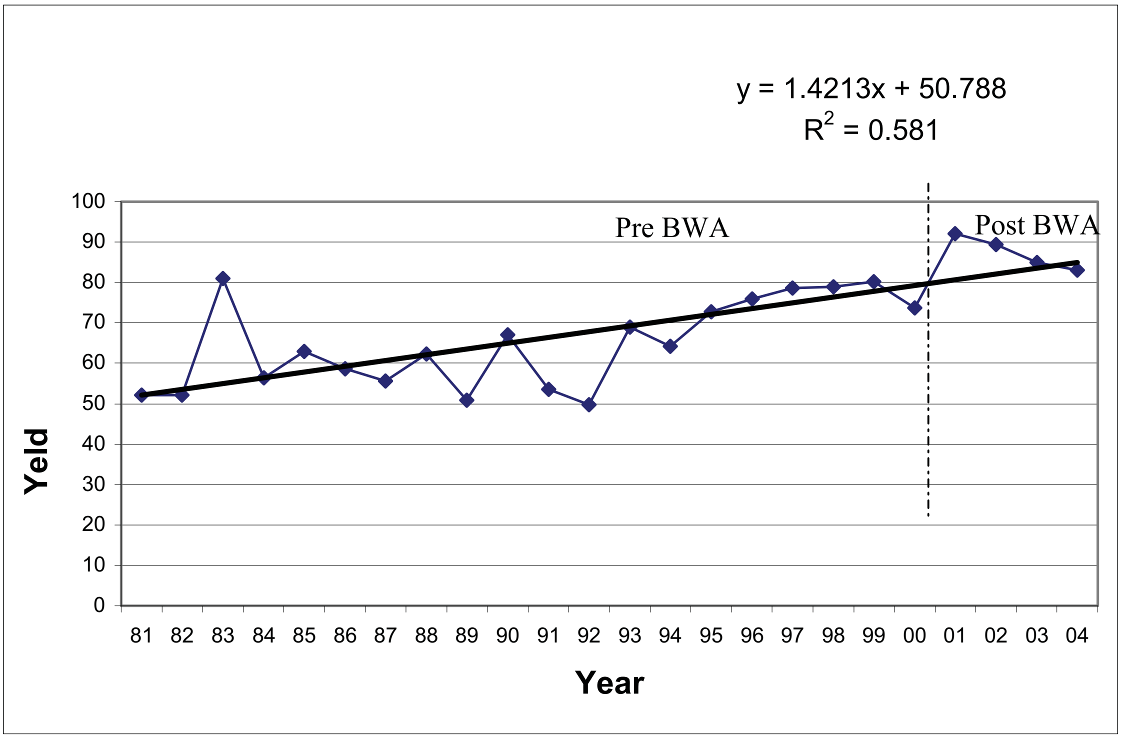


Figure 4. Changes in rice yield in Mahaweli H –*dry s*easons

4.2.4. Land and water productivity

Land and water productivity values are calculated in terms of gross value of output obtained per hectare of land and per cubic meter of irrigation water respectively. Rice is the major crop in the Maheweli H system in wet seasons. Although there is a small extent of land under OFCs during wet seasons, due to non-availability of reliable data on yield and price of OFCs, the valuation was limited to rice cultivation. The international price of rice was calculated at 2005 constant US dollars. Productivity values were estimated from 1999/2000 to 2004/2005 wet season. To avoid the effect of price fluctuation of rice in local and world market the average prices are used for the reference period (1999-2005).

The findings on land and water productivity are illustrated in figure 5. The figure shows that land productivity has not increased much over the time compared to pre vs post BWA. However water productivity values are showing an increasing trend after BWA indicating the performances in water distribution.

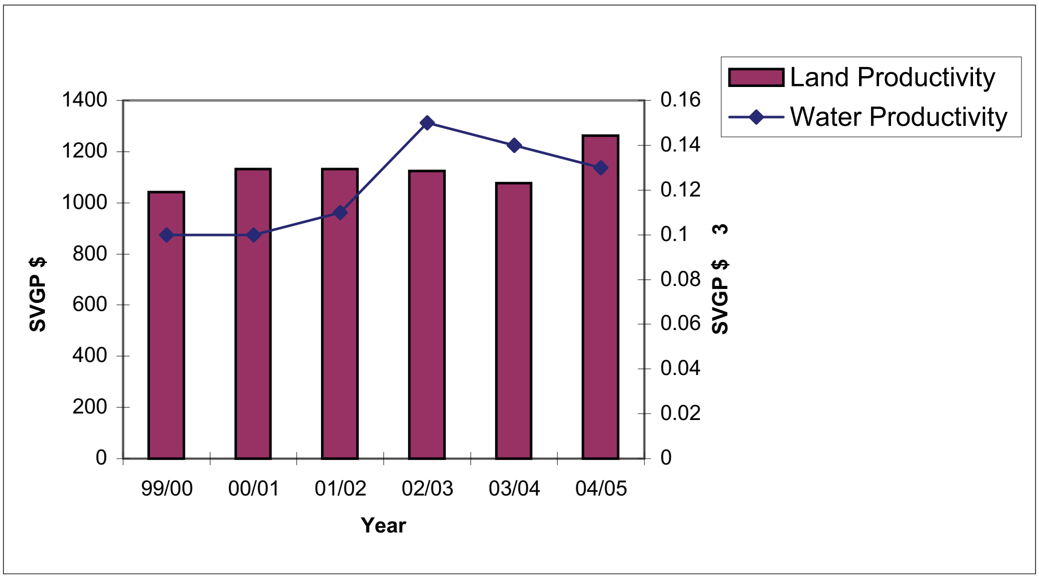


Figure 5. changes in land and water productivity

Table 1 highlights the summary of the findings of the irrigation system performances achieved with the implementation of BWA. The results show that there is a tremendous increase on the performances of the area irrigated per unit of water, extent under non rice crops and percentage area cultivated during dry seasons.

Table 1. Summary of selected performance parameters

Performance parameters		Performance before BWA (1996-2000)		Performance after BWA (2001-2005)		Percent change	
		Wet season	Dry season	Wet season	Dry season	Wet season	Dry season
1.	Tank water duty (m)	1.18	1.50	0.889	0.94	-24.6	-37.3
2.	Area irrigated per unit of water (ha/MCM)	88.9	81.39	119.36	119.96	+34.26	+47.38
3.	Water productivity (wet season) (US$/m^3)	0.1	-	0.13	-	+30	-
4.	Land productivity(wet season (US$/ha)	1087.5	-	1148.9	-	+5.6	-
5.	Rice yield (t/ha)	5.03	3.98	5.21	4.49	+3.6	+12.7
6.	Extent under non rice crops (ha)	865.75	5854	1041.75	8971	+20.3	+53.2
7.	% of land extent cultivated in dry season	-	42.45	-	64.63	-	+52.2
8.	Annual cropping intensity	148.25		164.11		+10.7	

4.3. FARMER PERFORMANCE INDEX

Pingali et-al (1990) has developed an index called farmer performance index, which was defined as the ratio of farmer yield to the location specific yield potential. The indictor provides an idea of farmers' ability to exploit the yield potential in the given circumstances. According to Deputy Resident Project Manager (Agriculture) of Mahaweli H, the potential paddy yield of the Mahweli H area is 6 metric tones per hectare. The performance index has been calculated separately for the rice farmers both in head end and tail end of branch canals and both wet and dry seasons. Farmer performance index developed for 2005 dry season is illustrated in figure 6. According to these findings, on average farmers have achieved 93% (5580kg/ha) and 80% (4796kg/ha) of the technical efficiency in paddy cultivation during wet and dry seasons respectively in year 2004/2005. The findings also suggest that about 31% of farmers during wet season both in head and tail end areas and 15 of the farmers during dry season were able to exceed the yield potential. About 55% and 38% of farmers achieved the technical efficiency of 85-110 during wet and dry respectively.

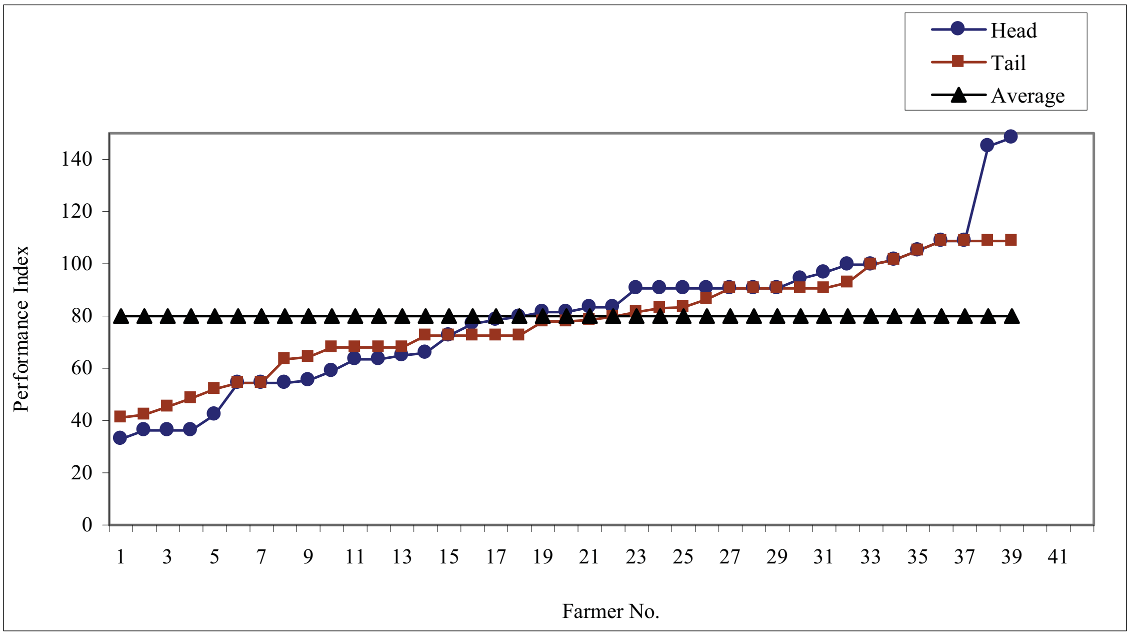


Figure 6. Farmer performance index for head end tail areas (dry season-2005)

4.3. FARMER PERCEPTIONS ON IRRIGATION SYSTEMS PERFORMANCE REALIZED AFTER BWA

Almost all the farmers were in favor of the performances realized from BWA compared to water management practices implemented in the past. The main benefit of BWA is farmers' know how about the water quota they are expected to get in the season in advance which has helped them to plan for cropping system and cultivation practices accordingly. About 95 percent of farmers perceived that they always or usually get their fair share of water while only 5 percent mentioned that they sometime get their fair share of water.

The perceptions on impacts of BWA on crop yield, income from agriculture and profitability of agriculture are positive for large proportion of farmers. About 50 percent of farmers perceived that, income and profitability of agriculture has increased after implementation of BWA. WUA leaders of all selected location perceived that, correct amount of water supply has lead to significant yield increase in paddy cultivation.

Increase of income has achieved by farmers during both seasons via increase in extent of cultivation and cultivation of high value crops. The achieved benefits from BWA programme have motivated framers to contribute more toward irrigation system O&M. The survey findings shows that O&M fee is regularly paid by 92 percent of farmers in head end areas and 100 percent farmers in tail end areas, showing the enormous concerns of farmers in sustainable O&M of irrigation system

5. CONCLUDING REMARKS

BWA programme has resulted in improving water supply performance and agricultural production performance. Performance of water supply after BWA has improved considerably in terms of gross water quota allocated during both wet and dry seasons at block levels. The block level water duty has reduced at the average of 24.6 percent and 37.3 percent respectively during wet and dry seasons. Extent cultivated during dry seasons after BWA has increased at the average of 52 percent, with an increase of annual cropping intensity by 10.7 percent.

Area irrigated per unit of water had increased by 34 percent and water productivity values has risen by 30 percent after BWA programme. Extent under less water consuming, high value cash crops has shown a 52 percent increase with the implementation of BWA.

The approach and methodology adopted for the implementation of BWA programme in Mahaweli H area provides good lesson of experiences for rest of the major irrigation schemes, which are having suitable infrastructure and experiencing water allocation problems. In addition to the hardware aspects of development by MRRP, the software parts of development activities including institutional development, private sector involvement in forward purchase arrangements and collaborative supports received from other government agencies are noteworthy features of this water management programme.

Comprehensive devolution policy for the irrigation sector with clear arrangement for roles and responsibilities and assured water supply provide tangible benefits which can encourage farmers to invest in the long term sustainability of their irrigation infrastructure. Allocation and sharing of responsibilities should be with clear policy demarcations on who is responsible for the specified activities and who can be made accountable if these activities do not take place. The irrigation management transfer should widen up the focus beyond mere cost recovery but in helping and creating an environment to generate the necessary development impulses for increasing agricultural productivity, marketing linkages, scale of production and farmers income.

REFERENCES

1. Aheeyar, M.M.M. 1997. "Participatory Irrigation Management and Sustainability of Irrigation Infrastructure: A case of Irrigation management turnover in Sri Lanka," Proceedings of the International conference on Large scale Water Resources Development in Developing countries: New Dimensions of problems and prospects, October 20th-23rd, Kathmandu, Nepal.
2. Gunaratne, B. 2003. Bulk Water Allocation Concept for Improving Water Productivity- A Pilot Study in Mahaweli System H. In R.P. De Silva (ed), *Water Resources Research in Sri Lanka*, Postgraduate Institute of Agriculture, University of Peradeniya, Peradeniya.
3. Mathmaluwa. S, 2003. The Effect of Irrigation Management Transfer on the productivity of an Irrigation system. A study on the Madatugama block of Mahaweli system H. Thesis submitted in partial fulfillment of the degree of Master of Science in soil and Water, Waganingen University, The Netherlands.
4. Pingali, P.L., Moya, P.F. and Velasco, L.E. 1990. The Post Green revolution Blues in Asia Rice Production. International Rice Research Institute, Manila, Philippines.
5. Samad, M. and D. Vermillion. 1999. Assessment of Participatory Management of Irrigation Schemes in Sri Lanka: Partial Reforms, Partial Benefits. Research Report No. 34, International Water Management Institute, Colombo.
6. Teams, 2003. An Independent Audit to Evaluate the performance of Madatugama block in system H under MRRP programme, Report submitted to Mahaweli Authority of Sri Lanka, T.B. Jayah Mawatha, Colombo 10 (unpublished Report).

TRADITIONAL WATER HARVESTING SYSTEMS AND MANAGEMENT IN WADI HADHRAMOU YEMEN

Dr. Mohamed Al-Hebshi[1] & Eng. Saleh Ahmed Bin Rabaa[2]

ABSTRACT

Wadi Hadhramout, a key area for agricultural production, is located in Southern East of Yemen . Yemeni civilization had prospered in an area where water is the most limiting factor. Traditional methods of water resources control, storage and delivery including soil erosion prevention, rainwater harvesting, and irrigation and drinking water-delivery structures, some of which have survived for many centuries. This indigenous knowledge has neither been well documented nor scientifically analyzed in order to utilize it for supporting the sustainable development of rain-fed runoff and spate irrigated farming.

In some areas the water management and water rights are known as the Habits (ALAADAT) which other areas sometimes use these habits to solve unprecedented problems in water management and water rights in these areas.

A long experience in water harvesting and management as well as the maintenance of the irrigation structures systems are nearly to be disappeared and no record is known for this experience. During the period 1970 - 1990 of the Communist Regime in the Southern Governorate, the agricultural land was taken from its owners and distributed to others, thus participated in the negligence of the traditions. After the Unity the lands were returned to its owner. Also after the unity water acompanying oil add other problems.

It is of most important to find out the water management experienced in the water harvesting agricultural areas and test the possibilities to get lesson from it to improve water harvesting.

1 - INTRODUCTION BACKGROUND

Wadi Hadhramout, a key area for agricultural production, is located in Southern East of Yemen, and physically isolated by mountains and desert. Yemeni civilization had prospered in an area where water is the most limiting factor. Water harvesting and

1 - Faculty of Agricultural Sana'a University; Republic of Yemen. malhebshi@hotmail.com or proff_alhebshi@yahoo.com Tel: 00967-77177011
2- Civil Engineer , MB ASCE - Director General - Local Water Supply and Sanitation Corporation Hadhramout Governorate Wadi & Deseret Regions Fox: +967 71575411 email: sbinrabaa@yahoo.com Phone: +967 77165411 mobile: +967 5 400375 Res:. + 967 5 405788 Off.

conservation have been developed and practiced for many centuries. Due to its location and the large differences in elevation and features of its mountainous area the Republic of Yemen (ROY) intercepts varying amounts of rainfall. Since early history, farmers have realized that agriculture is only possible by replenishing the plant available soil-water from limited and difficult to control water resources. Often, crop production is not possible under solely rain-fed condition and therefore runoff water harvesting and conservation are crucial for successful cropping.

Traditional methods of water resources control, storage and delivery including soil erosion prevention, rainwater harvesting, and irrigation and drinking water-delivery structures, some of which have survived for many centuries. These structures, being long lasting, indicate that advanced procedures had been followed in their design and construction. With their traditional knowledge, the farmers of ancient Yemen must have understood and analyzed data relating to rainfall, runoff, soils and climatic conditions associated with land and water resources management. This indigenous knowledge has neither been well documented nor scientifically analyzed in order to utilize it for supporting the sustainable development of rain-fed runoff and spate irrigated farming The Wadis from upstream wadi Hadhramout are:

1 - Wadi Doaan (Wadi Laiman ,Wadi Laiser , and Hajrain) 2 - Wadi Alain (Sudbeh , Hourah , Almokhainig) 3 - Wadi Amed (Amed , Horaidhah , Aandel) 4 - Wadi Rakhyah 5 - Wadi Hainen 6 - Wadi Sur (Shibam) 7- Wadi Bin Ali . 8 - Wadi Aedim

In some areas the water management and water rights are known as the Habits

(ALAADAT) which are not documented from which other areas sometimes use these habits to solve unprecedented problems in water management and water rights in these areas . Some (Aadats) habits Known in Wadi Hadhramout are known as Follow from upstream Wadi Hadhramout :- 1-Aadat Alhajrain, 2-Aadat Gabdhain 3- Aadat Sudbeh, 4- Aadat Aandal, 5- Aadat Ghailan ,6 - Aadat Jomaileh,7- Aadat Shibam

2- THE PROBLEM:

A long experience in water harvesting and management as well as the maintenance of the irrigation structures systems are nearly to be disappeared and no record is known for this experience. During the period 1970 - 1990 of the Communist Regime in the Southern Governorate, the agricultural land was taken from its owners and distributed to others, thus participated in the negligence of the traditions if not add new problems. After the Unity the lands were returned back to its owners. A new problem started with the oil production in Masilah (1993) when the oil produced acompany the water. As the irrigation systems and the agricultural activities in this area is very old the agricultural lands became widely distributed and rarely one land owner own (0.2) hectare in one place, more over due to cultural complication, it is very difficult to give up the land. The lands are spate irrigated excellent land. The ground water is available and the mean activities of the people is cultivation. It is required to test an unprecedented relationship for irrigation with ground water in scattered land ownership.

3 – METHODOLGY

This study has been reached by reviewing the literature in hand about Wadi Hadhramout, with field visits by the authors and personal experience and observations. Consultancy works done by authors in Wadi Hadhramout and other Yemen regions.

4 – WATER RESOURCES IN WADI HADHRAMOUT

4 – a - Surface

Water 4-a-1- Rain water:

The rain source is mostly the isolated cumulative clouds, this phenomena caused the rain fall on different isolated places which caused floods in some branches of wadi Hadhramout while other branches are dry. If it happened the clouds and then the rain spread over different branches simultaneously the floods from different branches accumulate and caused sever damage as it happened in the seventies. Wadi Hadhramout

catchment area receives main annual rainfall of a density ranges between 50 mm and 300 mm, the catchment lays over mountains in the west and far north west ,desert in northwest and wadi course and tributaries in the north and south plateau .

The catchment area is the largest in the Arab Peninsula.

The Wadi characteristic is unic in the world. In all wet or dry water courses the size of the wadi course at the beginning of the wadi is narrow and enlarged to the maximum size at the end which is not the case in wadi Hadhramout A long the wadi course there are many tributaries / branches counted more than fifty just down stream of Tarim Town.

4 - a - 2 – Floods

The rain source is mostly the isolated cumulative clouds, this phenomena caused the floods in some branches of wadi Hadhramout while the others are dry. If it happened the clouds and then the rain spread over different branches the floods from different branches accumulate and caused sever damage as it happened in the seventies.

Spate irrigation is an ancient form of water management, involving the diversion of flashy spate floods running off from mountainous catchments, using simple deflectors of bunds constructed from sand, stones and brushwood on the beds of normally dry wadis. Flood flows, usually flowing for only a few hours with appreciable discharges, and wit recession flows lasting for only one day to a few days, are channeled through short steep canals to bonded basins, which are flooded to depths of 0.75 m or more.

Subsistence crops, often cereals, are planted only after irrigation has occurred. Crops are grown from one or more irrigations using residual moisture stored in the deep alluvial soils formed from the sediments deposited from previous irrigations. This type of agriculture is very risk-prone and requires high levels of co-operation between farmers to divert and manage the distribution of flood flows. The Hadhramis community had ran the system, until the period 1970 - 1990 of the Communist Regime in the Southern Governorate, the agricultural land was taken from its owners and distributed to others, thus participated in the negligence of the traditional system since then spate irrigation system in Hadhramout is started degradation, **the damage to the irrigation infrastructure are from absent of maintenances** and poverty has increased. Most households in spate-irrigated areas are poor, with a per capita income generally less and in some cases far less, than US$1 per day.[1] Estimated net household revenues derived for some spate-irrigated systems 1 Traditional intakes are constructed from locally

1- Al- Hebshi Mohamed Abdul-Rahman Hashm, THE CYCLE OF POVERTY IN YEMEN, Sana'a, 2004 available materials. Large embankments (diversion bunds) are constructed with animal powered scraper boards, but this type of equipment cannot easily handle coarse gravel and cobbles. Diversion bunds are found on lower reaches of wadis, where the bed slopes, bed material sediment sizes and the flood peak discharges, are all lower than at the mountain fronts.[1]

The Average annual surface flow in Wadi Hadhramout is shown in the following table[2]:

Catchment Area (km2)	Mean Annual precipitation (mm/year)[a]	Average Annual surface flow (Mm3)[3]	Rechareg (Mm3)/year[3]	Net Abstraction (Mm3)/year[3]
46075	54	161	180	144

In Wadi Hadhramout branches the wadi flood is intercepted to divert the flood water for irrigation using various types of diversion structures through canals to the fields. Some structures such as drop structures, weirs, control structures.

1- www.metameta.nl/spate irrigation systems.
2- Tahir, T., "Water Harvesting Techniques in Yemen and Their Prospects in the Scaes Environment of Yemen" Water Harvesting Conference, Khartoum, Sudan, 19-20, Aug., 2003.

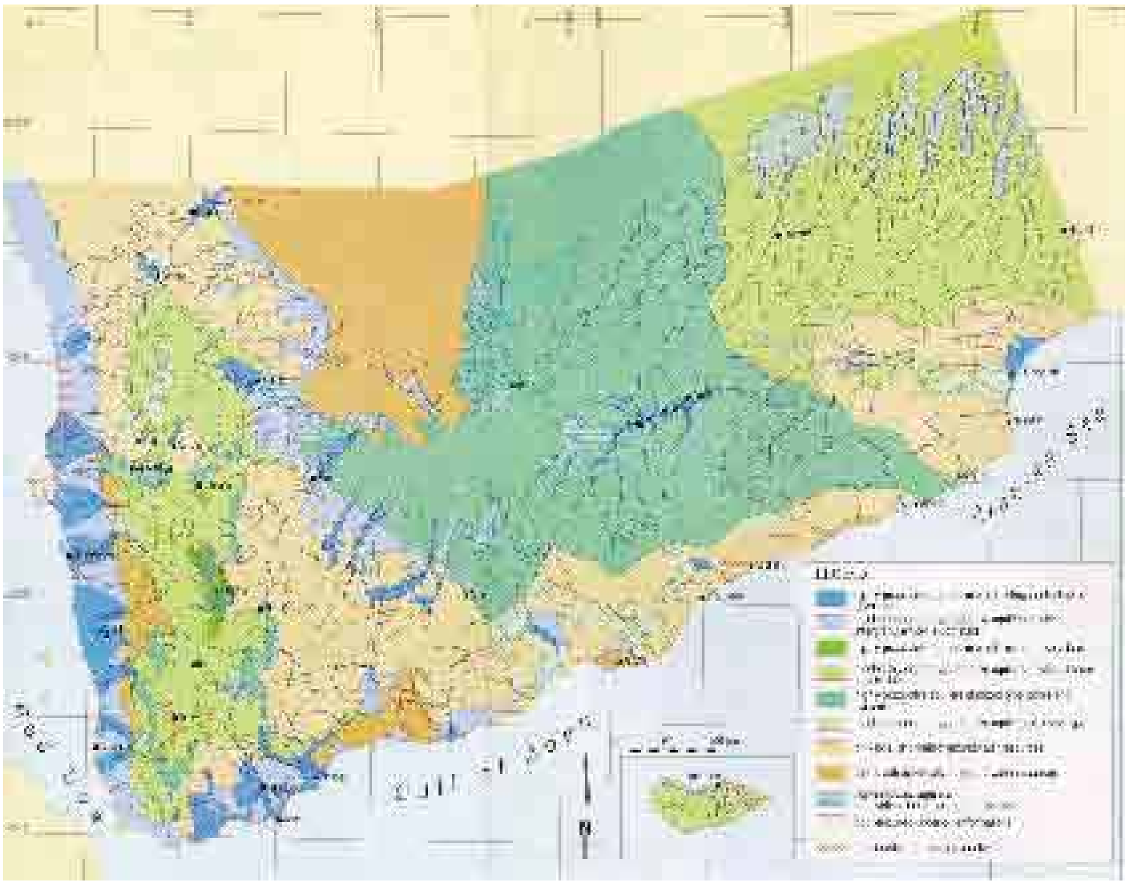
Farmer improved spate irrigation structures in the Hadramawt in Yemen
Diversion Weir with a stepped downstream face

4 – b - 1 – GROUND WATER

Since early times the farmers in wadi Hadhramout used to draw the ground water using labours and animals. Since early 50 s the mechanical engines started in wadi Hadhramout to be used to drew ground water for irrigation and for drinking purposes. A major groundwater aquifer was recently discovered in the eastern part of the country with an estimated storage of 360 billion m3 [1]. Table 1 explains deferent aquifers of Hadramout area, Aquifers Depth, Water by Millions Barrel In square mile.

1- LAHLOU ABDELHADI, WATER RESOURCES OF 11 WATERSHEDS IN NORTH YEMEN, 3rd International Conference on Wadi Hydrology, 12-15 December 2005, Sanaa, Yemen, lahlouhadi2004@Yahoo.fr

Groundwater Map –Yemen



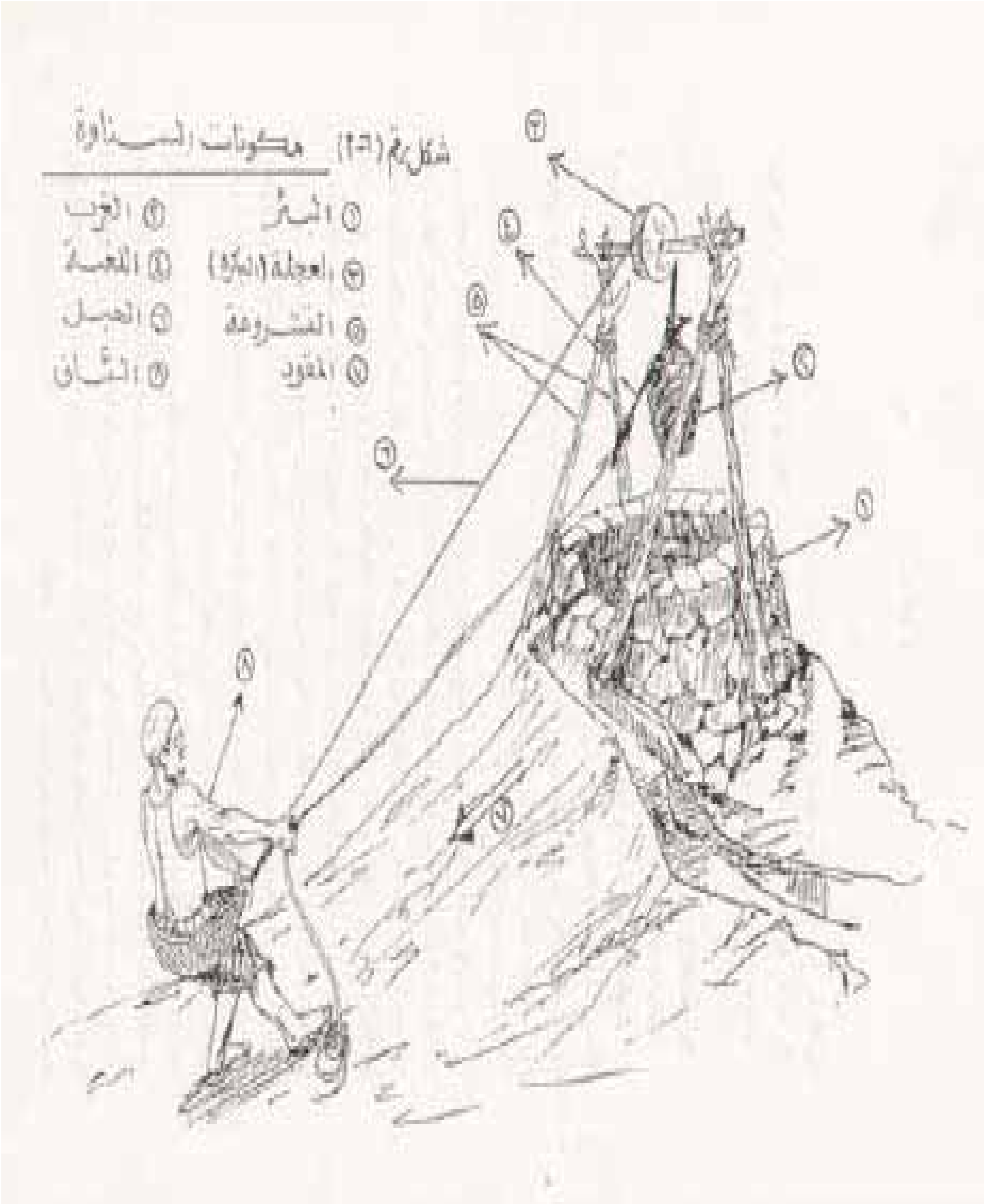

الغرب
العجلة (البكرة)
الحبل

Table (1) Typical Rock Formations In Masila Block Hadramout 1

No.	Aquifers	Aquifers Depth By Mater	Water by Millions Barrel In a squire Mail	Water Quality
1	Jeza	0 – 120		
2	Umm Eradhuma	180 – 270	Un-Know	Potable
3	Sharwayn	25 –50		
4	Mukalla	300 – 600	640	Potable
5	Fartaq	40 – 55		
6	Harshiyat	700 – 900	742	Potable
7	Qishn		96	Water & Oil

4 – b – 2 – DISPOSAL OF THE WATER ACCOMPANYING MASILAA OIL

Canadian Occidental Petroleum Ltd. (Canoxy), major operators in the Hadhramout-Masila block region of Yemen in 1992, retain Komex International Ltd (Komex) to provide an assessment of the ground water resources in the area. Komex year long study determine the existence of two previously unexplored major deep aquifers. Draw from this study suggest that these aquifers, which exist at over 800 m depth in most of the study area, offer excellent potential for good quality groundwater for potable supply and industrial or agricultural purposes. Initial estimates suggest that annuapotential safe yields from the aquifer could exceed several hundreds of millions of cubic meters, if properly developed.

Canoxy has retained Stanley International Consultants Ltd (Stanley) to conduct a study on the potential impacts of disposing of the produced Qishn water into the Harshiyat formation in the N.W Masila Block, Yemen. The study should, in particular, address the concern that disposal operations may impact the overlying Mukalla aquifer& the others, which contains potable water. For instance in table 2, when the oil is sold, a country appears to grow richer, even though depreciation of the natural capital - soils, and water - may create future losses several times greater than the present gain.[2]

5 – THE WATER RESOURSES DEVELOPMENT

Before the unity in 1990, the water recourse devin two opposite directions, In the north part of the country developing project concentrating on the wadi and flood control project and the exploitation of the ground water was left to the privet sector, while in the south the Government concentrate on the ground water exploitation neglecting the floods the wadi development although land reclamation projects were implemented depending on ground water. The privet sector was out of the equation in this field.

1- Canadian Occidental Petroleum, HYDROGEOLOCAL ASSESSMENT OF PRODUCED WATER DISPOSAL, Yemen Masila Project, April 1994, (p 48)

2- Dr Mohamed A. Al- Hebshi, Eng. Saleh Ahmed Bin Rabaa, Disposal of the Water Accompanying Masila Oil in Yemen, International Conference On Soil & Groundwater Contamination & Clean-up in Arid Countries, Sultan Qaboos, University, Oman, 20 – 23 January 2003

In early 1990 after the unity the situation was in the north part the ground water was exploited and in many regions it reached grave situation. and in the south the land ownership started and all the gained developed land became gradually desert.

And the wadis flood structures need heavy rehabilitation and maintenance while most of the people did not know how such structures used to be maintained.

Table (2) the Cost of Injection & Opportunity Costs of Masila Water Disposal

Total Cost	Opportunity Costs	Cost of Injection	Quantity Per Year	Injection Rate (BWPD.000)♣	Years
1029300	343100	686200	17155	47	1994
3153600	1051200	2102400	52560	144	1995
4730400	1576800	3153600	78840	216	1996
5825400	1941800	3883600	97090	266	1997
6942300	2314100	4628200	115705	317	1998
7402200	2467400	4934800	123370	338	1999
7840200	2613400	5226800	130670	358	2000
8081100	2693700	5387400	134685	369	2001
8256300	2752100	5504200	137605	377	2002
8015400	2671800	5343600	133590	366	2003
5256000	1752000	3504000	87600	240	2004
3766800	1255600	2511200	62780	172	2005
3438300	1146100	2292200	57305	157	2006
2868900	956300	1912600	47815	131	2007
2737500	912500	1825000	45625	125	2008
2387100	795700	1591400	39785	109	2009
1598700	532900	1065800	26645	73	2010
1554900	518300	1036600	25915	71	2011
1029300	343100	686200	17155	47	2012

1- Per day * by 365 Injection per Year
2- Estimated Cost of injection by 40 YR Per Barrel
3- Opportunity cost per Barrel of Water is estimated by 20 YR

6 – CONJUNCTIVE USE OF FLOOD AND GROUND WATER

The conjungtive use of flood and ground water was not experienced widely in wadi Hadhramout. There is an old saying farmers used to say if the rain does not come we will draw water from the ground using the humans and the animals (أن مطرت و لا سنينا)

The practice of using ground water and flood is widely experienced in Tihama region West of Yemen as the wadis flood is controlled by modern permanent structures which is not the case in Wadi Hadhramout.

7 – CONCLUSIONS

Soil and water management in spate systems is vital for three reasons. The first is the soils are largely induced by human activity. They are built up from the sediments transported with the spate flows that settle when water is bunds on bunds fields. The water holding capacity and fertility of these soils is usually excellent, but soil management is required to counter land rise, maintain fertility, and in some areas to avoid soil crusting and compaction. The second reason is the importance of moisture conservation in crop production. In spate systems irrigation before planting provides the main source of crop moisture. Conserving this moisture is essential to crop production. Good moisture conservation can have an impact on production often greater than improvements to the water diversion systems. The third is the positive and lasting impact by developing successful partnerships built on mutual trust and respect with farmers, land owners and the local communities where they work and live to gather peacefully. The lands are spate irrigated of excellent soil. The ground water is **Al-Hebshi &. Rabaa** available and the mean activities of the people is cultivation . It is required to test an unprecedented relationship for irrigation with ground water in scattered land ownership taking into consideration the possibility of flood irrigation as conjunctive use of ground and flood water.

The Water Company the oil production from a deep aquifer and it is effects in environment is scurries problem in Yemen.

8- REFERNCES:

1- Al- Hebshi Mohamed Abdul-Rahman Hashm, THE CYCLE OF POVERTY IN YEMEN, Sana'a, 2004

2- Al- Hebshi Mohamed A., Eng. Saleh Ahmed Bin Rabaa, Disposal of the Water Accompanying Masila Oil in Yemen, International Conference On Soil & Groundwater Contamination & Clean-up in Arid Countries, Sultan Qaboos, University, Oman, 20 – 23 January 2003

3- CANADIAN OCCIDENTAL PETROLEUM, Hydrological Assessment of Produced Water Disposal Yemen Masila Project (April 1994)

4- CANADIAN OCCIDENTAL PETROLEUM. Yemen Masila Project Water Treatment Disposal options (April 1994)

5- David Brooks, "Oil and Water Can Mix", LEDS, Vol. 8 No. 4, Oct. 1997, Canada

6- LAHLOU ABDELHADI, WATER RESOURCES OF 11 WATERSHEDS IN NORTH YEMEN, 3rd International Conference on Wadi Hydrology, 12-15 December 2005, Sanaa, Yemen, lahlouhadi2004@Yahoo.fr

7- Tahir, T., "Water Harvesting Techniques in Yemen and Their Prospects in the Scaes Environment of Yemen" Water Harvesting Conference, Khartoum, Sudan, 19-20, Aug., 2003

8- www.metameta.nl/spate irrigation systems

OBSTACLES TO FARMERS PARTICIPATION IN IRRIGATION AND DRAINAGE MANAGEMENT IN IRAN

Dr. M. Fekri Ershad[1]

ABSTRACT

Experiences of 1950's and 1960's revealed the importance of public participation in success of development programs of developing countries. Based on new visions, a prerequisite of rural sustainable development is active, conscious and voluntary participation of farmer in the process of decision-making, planning and management of all programs. This sort of participation in decision making and handling of social affairs is both an effective factor on development and a product of development process.

Promoting farmers participation in management of irrigation networks merely consist a part of social interaction between different social groups, i.e. government and villagers. Therefore, before dealing with participation issue, one should first deal with social interaction of a given society. Since these interactions and their historical changes differ among different societies, applying the successful models for participation of a given country, would not necessarily lead to success in another country.

Throughout the history, Iran has had always a despotic government, and all social rights were exclusively determined by the government, and therefore all responsibilities and public issues were to be dealt by the government. Since people had no objective social rights, they felt no responsibility in front of the government. The result is a distorted view of government-nation relationship in which the nation considered itself as the servant of the government. This distorted attitude is still vastly spread among our people-specially farmers, and its perpetuation is the main obstacle in front of their active participation in management of rural issues. The prerequisite of farmer's active participation including participation in management of irrigation network is the change in this distorted attitude of state-nation relationship. Achieving such a change requires education and promotion of a new attitude towards participation, which is a long patience-demanding process.

Keyword: Farmers participation, despotism, absolutism, social interaction, private ownership, democracy, social status

1- Tehran Univercity- IDRO-Valieasr Building-Jam e Jam Str. Valiasr ave. Tel: 009821-23862132 Fax: 009821-23862288; E-mail: Fekri@idro.org

I- INTRODUCTION

The experiences during these two decades, 1950's and 1960's shows although the governments were effective in the growth of agriculture in the developing countries including Iran by establishing large water conveyance and water supply structures, the lack of farmer attendance in irrigation networks' management and planning caused several problems which were effective in the failure of the governmental growth and development plans of the developing countries.

The experiences of these years made it clear that the governmental organizations and the staffs are not interested in consulting and cooperating with local communities and always behave imperiously with them. Actually, the governmental agencies believed that farmers were not able to recognize their own good. So in order to insert the new ideas and methods, they must be persuaded to follow the expert's social and technical recommendations. This attitude is clearly against the modern aspects of growth and development. The new views consider active, awareness and voluntary attendance of public in the procedure of decision making, planning, executing and managing as one of the conditions for sustainable development plan. So in order to approach the rural development and productivity promotion on social and water resources depend on cooperation of all the authorities (public and government).

Thus the lack of farmers' participation in the rural affairs, (among them irrigation networks management) was known as one of the reasons for the failure of the development plans, consequently the concept of participation became the most important pre-condition for the growth and development plans which should be paid attention.

But the lack of farmers' participation in growth and development faced the authorities by the following question: Why the farmers don't have a tendency toward participation in their own community affairs. The problem has been cleared now.

What is the Reason for the Lack of Framers' participation in the rural Development plans?

What remained was to find the solution:

How can we persuade the farmers to be active in the development plans?

Then the experts seriously started investigating on the effective factors to attract farmers' participation in the development plans and encouraging them to participate in the rural affairs.

II- PARTICIPATION AND SOCIAL INTERACTION

The new development ideas, concern human power as the most important effective factor in the sustainable development and call it as "the human capital". This capital will flourish and help the development procedure when it has the right to make decision freely. Stiglitz announced "the effective factor in the sustainable development is public participation in the affairs. This kind of participation should be based on responsibility feeling and free dialogue "in the International Conference on Democracy, Market Economy and Development" which was held in Seoul, in 1999. Public participation in making decision and administrating the community affairs is both effective factor in development and the result of development procedure. Actually there is a mutual causality between participation in the community affairs and the sustainable development. Farmers' participation attraction in the irrigation networks management means to transfer some of the responsibilities from a community sector (government) to another one (farmers) which actually cover a part of socio-economy interaction of different community groups. Thus before discussing about this issue, we should investigating and specifying the social interaction of certain social groups of the community. The experiences show without concerning the social interactions of social groups and their historical changes can not be sure about the success of participation plans. As far as the interaction of social groups and the historical changes in different societies haven't been the same, so taking the pattern from the methods of those successful countries may be fail in another country. For the same reason, it is necessary the selected methods of participation attraction in each country should be fit with the trend of historical changes of social interaction in that country. For this purpose we should investigate on historical relationship of the government and the public to know the willingness or unwillingness of the public to participate in the community decision making and consequently determine the degree of their responsibility acceptance.

III- HISTORICAL BACKGROUND OF THE GOVERNMENT AND THE PUBLIC RELATIONSHIP IN IRAN

I would like to mention to the historical background of the government and the public relationship, in order to explain the obstacles of farmers' participation in execution responsibilities acceptance in Iran- among them irrigation and drainage networks management and finally give some recommendations to defeat these obstacles.

Iran is a vast country , located in a dry and semi-dry region where the rural communities are mostly far from each other. Most of these rural communities are located in the dry regions. Actually they didn't have considerable surplus production in the past. The scattering state of rural communities and the scares of surplus product haven't let to establish an independent and powerful feudalism. Actually, only an active military force could collect the surplus product of those scattered villages and turned it to a powerful central government; and this active military force could mostly be prepared by the tribes. All these governments have been despotism ones during the history of Iran.

Before continuing the discussion I would like to point out the difference between absolutism (as it was organized in Europe) and the despotism (as it was dominated in eastern countries among them Iran). In absolutism, private ownership (specially land ownership) was respected and secured, while in despotism, the private ownership wasn't secure and most lands belonged to the government and land ownership wasn't an unclaimed right, but was a privilege which was granted by the government.

"Francois Bernier" the special physician of Orang Zib Mongol was written in his itinerary "king himself was the only owner of all the lands."

During the past, a large part of agricultural lands always belonged to the government and the government transferred them to the people. Actually the agricultural lands ownership was not a right, it was a privilege which was granted to government's agents and any time they wished they would take them back. Of course there was some piece of lands which belonged to land lords, but even those lands could be expropriate very easily. Even the wealth of people and their social status needed the approval of the government.

From the view point of sociology, although the absolute government depends upon influential of social classes of the society and the existence and legitimacy of the government would be on the hands of influential social classes and their satisfaction, the high social classes of the society and their wealth were indebted to the king of the despotic government.

In Iran, the will of the despotic king didn’t have any restriction. Although there were some regulations in Iran, but there was no written legal criteria. The specialty about the despotic government was: “lack of equality in front of laws”. Caloshkin, the Russian permanent delegate during Nader Shah, (1741) wrote: “the king successively changes the ministers, governors and commandeer their properties on behalf of him. I can say I have never seen even one of the commanders to be secured after losing his status.” The most recent despotic government of Iran was Ghajar dynasty. Lord Croson pointed out “king can do what ever he wants and his words are as law… he can depose or assign all the ministers, officers, employees and judges. The life and death of all the members of royal family and all the civil and military personnel without any trial were in his hands. The properties of those who were executed would be granted to the king. In order to get a high position in the government, depend on the cost you should pay some bribery and gift."

The main differences of despotism and absolutism can be summarized as follow.

Absolutism	**Despotism**
1- Law oriented	1- Law disoriented
2- Although the king has absolute right in legislation, there are some main rules which should be fallow.	2- The king is free to do what he wants without concerning any rules.
3- Privet property, especially land property has been respected and is secured.	3- Land property is not a right; it is a privilege which is granted to the people.
4- The government is relevant to high social class of society.	4- The high social class of society is relevant to the government.

As far as the whole rights of the society have been in the hands of despotic government during the past history of Iran, all the responsibilities and public tasks had been undertook by the government. In other words, because the people didn’t have any rights, so they didn’t feel any responsibility in front of government.

IV_ PUBLIC ALIENATION FROM GOVERNMENT IN IRAN

The result which has been concerned from what have been discussed was the alienation of the social classes from government. This kind of public alienation from government has been continued up to now, in spite of changes after constitutional revolution (1906). This historical alienation has caused an inverted understanding from the relation between the nation and the government in Iran.

In European countries, the government is elected by the nation as an employee of the public to serve the society since industrial revolution and establishing democracy. While the continuation of despotic government in Iran has drawn an inverted vision from the relation between the nation and the government in the public's mind. In other words, as far as the central government has been the only owner of the public's wealth, the people have been stipendiary, servant and peasant of the government under certain hierarchy. This kind of inverted understanding from the relationship between the nation and the government has been remained in the mind of the majority of the people in our country yet. Still the people think of the role of government as governor and ruler. The farmers' expectation from the government as a supporter and benefactor have been increased specially after revolution and caused to strengthen the same inverted understanding from the relationship between the nation and the government. The continuation of the same understanding is the main obstacle of active participation of the farmers in the rural affairs, especially in development affairs and responsibility acceptance.

Although because of limited area, population density and urban living significant in the cities, the people have more or less believed in order to manage the complicated affairs of the city all the people should participate and work together. But this belief has not been justified in the rural communities yet, still the farmers haven't accepted that they have to perform and participate in a part of services which have been executed by the government and some of the government agencies so far.

V-PRECONDITION OF FARMERS' ACTIVE PARTICIPATION IN THE RURAL AFFAIRS

Participation in the irrigation networks management, as the preconditions of farmers' active participation in the rural affairs, requires attaining the new attitude of the relation of the government and the public and inverting those imaginations which have been existed so far. As far as this new attitude has been based on democracy, the separation of farmers' participation procedure and the expansion of democracy cause to make transient decision and policies which is just wasting time and manpower. We shouldn't expect the procedure of participation attraction to be faster than the procedure of democracy expansion. At most the procedure of participation can be forwarded in step with democracy in the society. Regarding the causality of these two issues, it should be mentioned in order to stabilize the public participation in the community affairs- among them farmers' participation in the irrigation networks management should be patient and take steps slowly but making the farmers participate in the irrigation networks management without feeling deeply the necessity and benefits of participation will be a kind of unsustainable participation which will be broken up by any changes in the government existing policy. It is impossible to make the farmers participate in the rural affairs administration either by force or granting some financial privileges. The only way to encourage the farmer to participate in the rural affairs is to make them understand the necessity and the benefits of cooperation and participation in decision making.

VI-TRADITIONAL COOPERATION AND PARTICIPATION IN THE MODERN SOCIETIES

However from many years before the cooperation and participation in the rural affairs have been dominated in the country, the land reform performance in 1963 changed the infrastructure of rural community and this kind of traditional cooperation has gradually paled. Some new phenomena have entered in the economical and social life of the village since 1960 decade, after performing land reform where the most important one was the attendance of government and the relevant agencies. From that time we have been the evidence of gradual weakening of traditional cooperation patterns in the rural area, because in many cases the governmental plans for rural development were dissimilar with the pattern of farmers' traditional cooperation.

Whenever we talk about farmers' participation in irrigation and drainage networks and the relevant problems, some opinions have been paid attention to the rural communities and revival of this traditional cooperation structure as the solution to the problem of farmers' participation attraction in the modern establishment management of irrigation and drainage networks. But it should be paid attention the active participation in modern irrigation networks administration is different from the traditional cooperation, because solving these days problems whit traditional methods are impossible. In traditional cooperation, there are a limited individuals belong to rather homogeneous communities who are cooperated together in the frame of individual or relationship, which cooperation and participation means consciously acceptance of continues cooperation with other members of the society and responsibility acceptance in order to access to the group objectives in nowadays large and inhomogeneous communities.

Actually consciously acceptance is the most important phenomenon of participation. People should consciously feel the necessity and benefits of participation and use their energies for a common objective without any obligation. For this purpose the issue of participation should have harmony with their benefits and interests; besides people should be in decision making as well.

The meaning of cooperation in the participation procedure is much more expanded one. When a person accepts a certain task, it is not necessary to perform that job, actually he promises not to disagree with. But cooperation needs a kind of action and interaction which asks necessarily for collaboration. In order to create such an interaction it is necessary the people do not feel that participation arrangement will be a threat against their benefits and social status and finally responsibility acceptance means unity with the people on the one hand and the project success on the other hand. In order to create such feeling the benefits of participation should be higher than the costs.

Here are some examples for participation and cooperation attraction of farmers which have been applied by the higher level authorities by establishing rural cooperatives, equity centers, cultural centers and other similar semi-governmental institutions.

In this trend the people are ignored, in other words the relation between the government staffs and the farmers are as commanders and obedient and instead of leaving the farmers in the different levels of participation decision makings, their tasks are applied to them. So by this method the independency of farmers to the government will be increased.

The most suitable form of participation in the society affairs is to establish executive agencies by the public intention on behalf of their clients. The municipalities can be the most important ones in the modern communities. Farmers' participation attraction should be performed by such executive institutions which are established by the farmers' intention. Only this kind of participation can help the growth and sustainable development of the rural areas. We can't expect, the farmers undertake the management of repair, maintenance and water distribution in the main canals besides the difficult job they have in agricultural affairs. Actually one of the problems of framers participation attraction is the interference of these activities in the irrigation networks management. There should be a mediator service institution to undertake the executive management of the modern irrigation and drainage networks on behalf of farmers in order to overcome this problem.

For this purpose we can hire the qualified manpower in order to establish private service agencies to operate the installments and the irrigation and drainage networks. The present governmental organizations will be replaced by these agencies as the farmers' executive organization. Establishment of this type of professional agency shouldn't be the way is happened today. In order to secure the success of this method, we should create a kind of motive in farmers as the first stage to appear voluntarily as applicant for those services. It is obvious the governmental organizations can also be very effective in technical supervision and establishment of professional agencies of private sector. Encouraging the farmers to step forward in this line, we should dominate the culture and the new view of participation in villages before. But besides the farmers, the authorities in rural affairs should expand the horizon of their view about participation and shouldn't limit theirs just on farmers' financial one.

It is valuable to motion to the view of one of the executive authorities of one of the water conveyance projects about a questionnaire which was provided for gathering the farmers' opinions and intentions to participation.

> "The questions are to be placed in a form, so that the participation does not seem as a voluntary subject. During the interview, the farmers are to made ready for accept the participation"

As you notice in the above phrase, participation has been concerned as an obligation, not a voluntary affair.

VII- CONCLUSION

At the end, once again it should be emphasized that the most important thing which should be done to attract the farmers to participate in irrigation and drainage management is to train and promote the participation culture; of course it takes time and asks for patience.

The new understanding of participation has been trained in many countries these days. There should be also some training agencies in different level to train and promote participation especially in the rural communities in Iran. This procedure takes time and need patient to progress step by step.

REFERENCES

1- The Social History of Iran, M. Ravandi.

2- The Story of Civilization, Will and Ariel Durant.

3- Opposition of The Government and The Nation, M.A Homayon Katozian.

4- Irrigation Management Transfer, Why & How?, Sayyed A. Heydarian.

ICWC OF CENTRAL ASIA AS INCTITUTE OF REGIONAL WATER SECURITY

Rysbekov Yusup[1]

ABSTRACT

As is known, water use from trans-boundary rivers of Central Asia (CA) has a huge conflict potential. Issues related to equitable water allocation between the regional states and their mutually beneficial use are kept in view of the Heads of CA States. In the beginning of 1990s the CA Governments have signed the Agreement about cooperation in area of regional water resources' use and protection (Alma-Ata, 1992). According to this Agreement, the Interstate Commission for Water Coordination (ICWC) of CA established, and earlier accepted legal acts regarding regional water management remain in force, in particularly – interstate water distribution is based on Water Use and Protection Master-Plans (WUPMP) developed in 1980s for the Amudarya and Syrdarya river basins. Establishment of ICWC was an important step towards keeping "status-quo" in regional water management. ICWC decisions are fulfilled through its executive authorities – Basin Water Organization (BWO) "Amudarya" and BWO "Syrdarya". ICWC determines water policy in the region and its major direction. According to the Agreement 1992: a) ICWC is responsible for general governance of the regional water management system; b) high officials of main water departments of CA countries are the members of ICWC; c) ICWC meetings are held on the quarterly basis in one of the state-founders; d) ICWC Decisions are accepted on consensus' basis; e) ICWC member has a right of "veto", thus ensuring high protection of national interests. ICWC acts as political institute of regional water safety, and its activity allowed avoid regional water conflicts predicted by western analysts.

1- Dr. Yusup Khaidarovich Rysbekov, Assistant Director
Scientific-Information Center of Interstate Coordination Water Commission (SIC ICWC) of Central Asia.
11, Karasu-4, Tashkent, 700187, Republic of Uzbekistan; Tel. (998 712) 651659; Fax: (998 71) 1665097
E-mails: <yusuprysbekov@icwc-aral.uz>, <Yusuf.Bek.004@rambler.ru>

1. POST-SOVIET PERIOD: POLITICAL PROCESSES AND THEIR INFLUENCE ON REGIONAL WATER RELATIONS IN CENTRAL ASIA

1.1. NATIONAL INTERESTS OF THE CENTRAL ASIAN COUNTRIES IN THE INTERSTATE WATER RELATIONS' SPHERE AND REGIONAL WATER SECURITY

In the beginning of 1990s geopolitics has changed cardinally, and a system of the international relations became more unstable. The developing realities have caused not only choice's freedom of the further development ways by new subjects of world politics, but also exclusive complexity of this choice.

At the same time, the Cold War's ending has given mankind chance in another way to look at the world and occurring processes on the Earth. One of advantages of new international relations' system became by the majority of the states a fact's recognition that the safety depends as a whole on joint efforts. Said fairly concerning new independent states of Central Asia (CA) - Republic of Kazakhstan, Kyrgyz Republic, Republic of Tajikistan, Turkmenistan and Republic of Uzbekistan, each of which has the tasks on protection of national interests, external-politics aspects of which are closely bound with problems of regional and global security. The categories "national interests" and "national security" are closely connected, include various kinds (political, legal, economic and others, in their interrelation and dynamics) and carry system character. Though in general security system the national security is a subsystem of global and regional security, the concept "national security" is key concept in the security of various levels. The global and regional security does not exist in the abstract kind, and they are derivative of national safety - both in a historical context, and by way of stability and opportunities of its maintenance. Taking into account that the essence of national security is national interests' protection in various spheres of social-political life, problems of trans-boundary water resources (TWR) use in CA should be considered through a prism of national interests' protection.

Last years ecological security is included in the national security system of the states as one of its key components. In system of ecological security the problems, connected to the water factor, occupy the special place, among which fresh waters' deficiency is key. On the data of the World Water Council, to the 2050s about 2/3 world population will have a problem of fresh water's deficiency. According to the World Meteorological Organization/UNESCO estimation, 97.5% of World water resources are salty and 2.5% - fresh. From fresh waters 2.24% are inaccessible or are remote (polar ice, glaciers, and deep underground waters). Only 0.26% of total world waters are accessible fresh waters, which are a potential source of possible international and local conflicts.

As a consequence many analysts and experts count that correlation connection between ecological crisis situations in different areas of the World and conflicts on this basic is present, in XXI century the struggle for natural resources will become aggravated, and predict on the future specific wars – "water", "grain" and others "eco-wars" [2, 9, 11, 13, 15; etc]. "Nature resources' deficiency becomes... by reason of a confrontation, conflicts and wars.... A major kind of natural resources becomes water.... That we could buy for earlier money, it is necessary pay in blood" – so one of experts estimates the water relations' prospects in the world [12]. "If in XX century petroleum was called as liquid gold, in XXI century such definition will be given to fresh water. And the same as the petroleum brought the limited prosperity to the certain areas last hundred years and caused wars and conflicts, its place will be occupied by freshwater" [10].

In these forecasts the growing value of the fresh water resources is truth, but their deficiency as the conflicts' reason carries probable character and depends on decisive persons' skill to develop compromise national and interstate water politics.

1.2. DEVELOPING WATER SITUATION IN CENTRAL ASIA

Water situation in the Aral Sea Basin (ASB) can be estimated as rather difficult. From beginning of the 1990s water problems of the ASB became as factors of regional, and sharpest problems (for example, Aral Sea accident) - and global security. The most part of ASB waters are formed in Kyrgyzstan, Tajikistan, Afghanistan (upstream countries), and Kazakhstan, Turkmenistan, Uzbekistan are the basic water consumers.

By different estimations, Afghanistan uses now 1.5-2.0km^3/year, in North Afghanistan (Amu Darya upstream: Kokcha, Kunduz rivers etc.), is formed about 8-10km^3/year of water. About 25% of the ASB river flow is formed in Kyrgyzstan, and 80% Amudarya flow and practically all flow of the Zeravshan river is formed in Tajikistan. Kyrgyzstan and Tajikistan are interested to develop water-power engineering.

On Turkmen territory there are more than half of Tuyamuyun reservoir, which delivers water for Republic of Karakalpakstan and Khorezm province (Uzbekistan), head constructions and other infrastructure of the Amu-Bukhara machine canal (ABMC) and Karshi main canal (KMC). ABMC and KMC submit water for Bukhara, Navoi, Kashkadarya provinces of Uzbekistan. In Kyrgyzstan there are basic water sources of the Syrdarya river basin, Sokh, Andizhan, Kassansai reservoirs, which are constructed for maintenance by water of the Uzbek irrigated lands. Water delivery for Dzhizak, Syrdarya (to lesser degree - Tashkent) provinces depends substantially from Kairakkum hydrounit's work regime, which located in Tajikistan. Samarkand, Navoi, Kashkadarya and Dzhizak provinces of Uzbekistan use water from Zerafshan river, flow formation zone of which is in Tajikistan. More than 90% of water resources, used by Uzbekistan, are formed in Afghanistan, Kyrgyzstan, and Tajikistan.

Water delivery for Southern Kazakhstan (Shymkent province) carried out by interstate canals in Uzbekistan (located in Syrdarya and Tashkent provinces), for Syrdarya river downstream, including Northern Aral Sea, depends on work regime of the Toktogul (Kyrgyzstan), Kayrakkum (Tajikistan), Charvak (Uzbekistan) reservoirs.

As a whole, basic national interests of the upstream countries (Kyrgyzstan, Tajikistan) are connected to development of hydropower capacities, and downstream countries (Kazakhstan, Turkmenistan, Uzbekistan) - to water use for irrigation needs.

In opinion of many experts and analysts, in water use from trans-boundary rivers of CA the significant conflict potential is made, and water problems are occupied leading place among alarms' hierarchy for the future of the Central Asian region (CAR). Depending on developing political situation the regional water problems can become the factors of union or reintegration of the Central Asian states.

1.3. POLITICAL AND LEGAL BASES OF TRANS-BOUNDARY WATER MANAGEMENT IN CENTRAL ASIA

Basic directions of regional water politics are determined by the decisions of the CA States' Heads. The basic political-legal documents, in which the key principles of the regional water relations are determined, are following:

- Interstate Agreement (ISA), 1992 [5],
- Decisions of the CA States' Heads, 1993, according to which the International Fund for Saving the Aral Sea (IFAS) is created. Within Independence IFAS has accepted a number of important political decisions in sphere of the regional water resources use.
- ISA, 1993 [6],
- Concept (1993) of the CA States on problems of Aral Sea Basin (ASB), which has incorporated rules, which are entered to IWRM theory in modern understanding [3],
- Decision (1994) of the CA States' Heads and Russia Government, by which the First ASB-Program (ASBP-1) is confirmed [4],
- ISA, 1996 [8],
- Declaration and Statement of the CA States' Heads (Nukus, 1995; Issykkul, 1995; Almaty, 1997; Tashkent, 1998, 2001; Ashgabat, 1999; Dushanbe, 2002; etc.), according which the politics of sustainable water-ecological management in CAR is determined,
- ISA, 1998 [7],
- ASBP-2, prepared on behalf of the CA States' Heads and approved by them, is accepted in Dushanbe (2002). ASBP-2 is the key political document, which reflects the basic problems of the ASB in water and nature protection spheres [14].

Among the listed above documents the Agreements 1992, 1993, 1996 and 1998 are international legal acts, according to which trans-boundary WRM (TWRM) is carried out. Agreement 1993 is the more political document, which establishes the general approaches to the joint management of water and other natural resources in CA for improvement of socio-economic and ecologic situation in CAR.

The questions of TWRM in CA are a subject of consideration of other regional political structures also, in particular, such as the "Organization for Central Asian Cooperation" – OCAC (Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan, since 2004 - and Russia), the "Euro-Asian Economic Community" – EAEC (Belarus, Kazakhstan, Kyrgyzstan, Russia, Tajikistan, Uzbekistan) etc. For example, in frameworks of EAEC 26 Agreements should be accepted which are signed by the OCAC members, from them 8 Agreements concern to the water and hydropower regulation in CAR.

According to classification of Global Water Partnership, one of active and consecutive conductors of IWRM ideas, first two main elements of the favorable conditions for implementation of IWRM principles are: a) Political decisions ("water politics"); b) Legislative basis ("water politics in the law's form"). Analysis shows, that coordinated by the CA States' Heads the political support and decisions on realization of radical reforms in water sector of CAR (“regional water politics”) are available. Business with development of international-legal bases of TWRM in CA is a little bit more difficultly.

In particular, last years the certain efforts on development new water legislation are undertaken, however this work goes rather slowly. For instance, the ASBP-2 has 14 Priorities, from which first is called "Development of the coordinated mechanisms of the water resources complex management in the Aral Sea Basin". More than 10 ISA-drafts should be prepared according to the Priority #1 of the ASBP-2.

2. ICWC OF CENTRAL ASIA: ROOTS, CREATION, ACTIVITY

2.1. TASHKENT STATEMENT 1991 AND ALMA-ATA AGREEMENT 1992

ICWC of Central Asia is created according to the Agreement 1992, and it all researches know practically. However history of this Agreement’s preparation and signing is less known for many experts, and for some reasons it not mentioned. Long terms of preparation of a line of the regional Agreements’ drafts are one of reasons of this phenomenon. As mentioned above, more than 10 regional ISA’s drafts should be prepared according to the Priority #1 of the ASBP-2, on much from them terms of preparation have expired in 2004, 2005. Some Agreements’ draft (on Syrdarya, Water quality, Databases etc.) have a history 7-8 years and began to prepare long before acceptance of the ASBP-2, but any of them is not ready for signing by Parties.

At the same time, history of ICWC creation is unique and instructive in many respects.

After self-liquidation of Union SSR, first persons of National Water Agencies of Central Asia and Kazakhstan[1] sign a Statement (Tashkent, October 12, 1991) [17].

It is represented very useful to result this Statement completely, which is a starting point and beginning a process of ICWC creation[2]:

STATEMENT

Of Chiefs of Water authorities of republics of Central Asia and Kazakhstan

(Tashkent, October 12, 1991)

We, Chiefs of Water authorities of Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan and Turkmenistan, as the professionals, estimating inevitability of a difficult situation in connection by increasing water deficiency and aggravation of ecological intensity in the Aral Sea Basin, were based on a historical generality of the peoples of Central Asia and Kazakhstan, their equal rights and responsibility for maintenance of rational water resources’ use in region, believe necessary:

1. To recognize exclusive feature of the closed water basin, what is the Aral Sea region, and necessity of acceptance by everything the measures for prevention of negative consequences connected from it drying.

1- In the Soviet special geopolitics territory of the present 5 posts-Soviet republics of Central Asia were called as Middle (Central) Asia and Kazakhstan
2- Translation is informal.

2. To recognize indissoluble dependence and interrelation of interests of all republics in the decision of questions of sharing water resources Aral Sea Basin as single unit on common for all republics principles and fair regulation of their consumption in view of interests of all peoples living in region.
3. To count expedient, in conditions of infringement of former economic connections, association of working and potential capacities for sharing use, to continue study of opportunities for long-term cooperation, prospects development programs' development, and creation of joint organizational structures for coordination.
4. To carry out development and correction of inter-republican water limits and water use on years and separate sources in view of guaranteed water maintenance of Prearalie and Aral Sea.
5. To recognize that a preservation of relative balance, water maintenance of the Amudarya and Syrdarya rivers' downstream through an establishment of the certain water share of each republic are a prime-turn task for Prearalye problems' decision.
6. To provide an exchange of the complete information about water use, water infrastructure, legal and other documents determining the status of water as a resource and the order established in republics on its use.
7. To not accept unilateral actions having a negative consequence for other republics.
8. All dispute questions to permit with participation of the Chiefs of the republics' interested organizations and representative of the disinterested party.

Only our incorporated and coordinated actions can promote the effective decision of regional water problems in conditions of growing ecological intensity.

State Committee on Water Resources of Kazakh SSR, Chairman	N.Kipshakbayev
Ministry of Water Resources of Kyrgyzstan, Minister	V.Melnichenko
Ministry of Water Resources of Tajikistan, Minister	A.Nurov
Ministry of Water Resources of Uzbekistan, Minister	R.Giniyatullin
Ministry of Water Resources of Turkmen SSR, First Deputy Minister	A.Awezov

1. Is printed in Russian, on two sheets, with the right of translation on state languages of all republics, which authorities have signed present Statement, and for publication.
2. First (original) copy with signatures is kept in Ministry of Water Resources of Republic of Uzbekistan, others participants have a photocopy.
3. Is signed in Ministry of Water Resources of Republic of Uzbekistan.

This Statement is a starting point of ICWC creation. The period from time of fastening of idea ant its realization deserves the special attention, as on the question "why drafts of regional Agreements long prepare", in a number of cases the examples are resulted, when a process of preparation and conclusion of the international Agreements on water resources (India and Pakistan etc.) proceeded by decades. Only 130 days (From October

12, 1991 till February 18, 1992, less than 4 months) were required for preparation of the appropriate documents and realization of idea of ICWC creation, namely – for signing of the Agreement 1992 in Alma-Ata.

Agreement 1992 "About cooperation in sphere of a joint management of use and protection of water resources of interstate sources" was signed also by the first persons of National Water Agencies of CA republics, but already – on behalf of independent States as the Agreement's Parties. This historical Agreement was signed by Ministers: from Republic of Kazakhstan – N.Kipshakbayev, from Kyrgyz Republic – M.Zulpuyew, from Republic of Tajikistan – A.Nurov, from Turkmenistan – A.Ilamanov, from Republic of Uzbekistan – R.Giniyatullin.

According to the Agreement 1992, the ICWC of CA established, and earlier accepted legal acts regarding regional water management remain in force. Establishment of ICWC was an important step towards keeping "status-quo" in regional water management. ICWC decisions are fulfilled through its executive authorities – Basin Water Organization (BWO) "Amudarya" and BWO "Syrdarya". ICWC determines water policy in the region and its major direction. According to the Agreement 1992: a) ICWC is responsible for general governance of the regional water management system; b) high officials of main water departments of CA countries are the members of ICWC; c) ICWC meetings are held on the quarterly basis in one of the state-founders; d) ICWC Decisions are accepted on consensus' basis; e) ICWC member has a right of "veto", thus ensuring high protection of national interests. Political importance of the Agreement 1992 is confirmed by the Interstate Agreement 1993, which was signed by the CA States' Presidents in Kyzyl-Orda. In particular, in the Agreement 1993 is said, that the Parties count necessary: "to form on a parity basis Interstate Council on problems of the Aral Sea Basin and at it: … for Coordination Water Commission working according to the Agreement, signed February 18, 1992 in Alma-Ata".

2.2. ICWC OF CENTRAL ASIA: ACTIVITY AND SOME PROBLEMS

The Rules "About the Interstate Commission for Water Coordination of Central Asia" are accepted December 5, 1992 (Tashkent), according to which SIC ICWC [16]:

- Determines uniform water politics in region and develops its basic directions,
- Develops and confirms water limits for each State of CAR,
- Develops and carries out the regional ecological programs,
- Develops recommendations to Governments of the Parties on uniform price politics in sphere of regional water resources use,
- Promotes development of corporate communications,
- Coordinates water economic activity of regional scale,
- Creates uniform information system on water/land use, organizes their monitoring,
- Coordinates joint scientific-research activity etc.

ICWC decisions are carried out by its executive bodies:

- Basin Water Organization (BWO) “Amudarya” (basic tasks, as a whole: submission of established water limits to each state in Amudarya river basin, operation of hydraulic engineering structures of interstate importance, which are on its balance),
- BWO “Syrdarya” (basic tasks, as a whole: submission of established water limits to each state in Syrdarya river basin, operation of hydraulic engineering structures of interstate importance, which are on its balance),
- Secretariat (basic tasks, as a whole: maintenance of the ICWC decisions, financial control, international communications),
- Scientific-Information Centre (scientific-information maintenance of ICWC),
- Control-Metrological Centre (metrological devices and equipment).

ICWC executive bodies have status of the international organizations [1].

ICWC has wide rights and acts as institute of maintenance of regional water security in Central Asia. ICWC activity has allowed to save status-quo in TWRM and to avoid the water conflicts in Central Asia predicted by western analysts.

ICWC should act as the main political institute of maintenance of regional water security. As well as the national security, water security includes many aspects, in particular - political, legal, economic, social, educational, technological, personnel etc.

In this context the following existing problems require serious attention:

- Development of the regional Agreements’ drafts on water resources. The legal base stipulated ASBP-2 should be developed and this process should be sped up;
- Absence of monitoring of the signed Agreements’ performance. Last years a line of rules of the working Agreements (is especial - Agreement 1998) are not observed;
- Strengthening of potential and powers of the ICWC executive bodies. So, now both BWO do not supervise many water structure of interstate importance;
- Interchange of information on water resources. Now it is on unsatisfactory level, there is no close coordination with national hydro-meteorological bodies;
- Water quality management. While the ICWC activity is limited to management of trans-boundary water quantity;
- Absence of economic mechanisms of damage’s compensation caused other Party. Now they are not developed;
- Absence of public participation at preparation of the regional Agreements’ drafts and at acceptance of the ICWC decisions on water-ecological problems; etc.

CONCLUSION

Sustainable development of the CA States is impossible without solving the problems of regional TWRM, which boil down, if expressed in one phrase, to “mismatch of interests between upper and lower reaches of the trans-boundary rivers”, and the TWRM principles, reflected in agreements of the CA States’ Heads, may be formulated as “long-term mutually beneficial strategy of equitable and reasonable use of TWR”. For realization of political will and decisions of the CA States' Heads in this sphere of the interstate relations, first of all, legal bases of TWRM of region should be necessarily developed. In regional scale IWRM introduction is possible at desire of the Parties to use voluntary mechanisms of the resolution of conflict interests, not resorting to legal tools. At the same time, the legal bases of conflicts resolution will allow carry out national actions within legal field's limits. Strong international-legal base of TWRM of region is also factor of restraint of emotions and excludes pointlessness of disputes.

As is known, acceptance of the responsible political decisions requires clearness and definiteness. There is a good expression: "to act professionally competently is, first of all, to remember constantly about political criteria". So the ICWC founders acted, so the ICWC members should act for maintenance of regional water security in Central Asia. And in this matter it is not necessary to follow always western samples.

REFERENCES

1. Agreement between Governments of Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan "About the status of the International Fund for Saving the Aral Sea and its organizations", Tashkent, 1997.
2. Aleksandrov I. XXI century: hydro-resources and armed conflicts. // "Foreign Military Review", 1998, # 9 – pp. 2-5.
3. Concept of the CA States on problems of the Aral Sea Basin, Tashkent, 1993.
4. Decision of the CA States' Heads and Russia Government on the "Program of concrete actions on improvement of ecological conditions in Aral Sea Basin on nearest 3-5 years in view of socio-economic development of region" (ASBP-1), Nukus, 1994.
5. Interstate Agreement between Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan "About cooperation in sphere of a joint management of use and protection of water resources of interstate sources", Alma-Ata, 1992.
6. Interstate Agreement between Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan "About joint actions on decision of the Aral Sea's problems…", Kyzyl-Orda, 1993.
7. Interstate Agreement between Kazakhstan, Kyrgyzstan and Uzbekistan "About Syrdarya river basins' water-power resources use", Bishkek, 1998. Tajikistan has joined to the Agreement in 1999.
8. Interstate Agreement between Turkmenistan and Uzbekistan "About cooperation on water-economy questions", Chardzhou, 1996.
9. Kotov L. Negotiation with Bangladesh about Ganges' water distribution. //ITAR-TASS, series "AM", 25.07.1995 – pp. 9-11.
10. Kuram D.Kh. Vision 2050. //Water security in the world and region. – Tashkent: Information collection of SIC ICWC, # 1 (14), April 2001 - with 5-9 (with 7).
11. Palaria A. Restless waters of Euphrates. // "Compass", 1996, # 26 – pp. 31-34.
12. Peters P. Future conflicts' culture. // "Parameters", Winter 1995/96, 11 p.

13. Priscoli J.D. International conflicts connected concerning trans-boundary water resources. // Legal collection # 2 (9) – Tashkent: SIC ICWC, 2001 – pp. 157-180.
14. "Program of concrete actions on improvement of ecological and socio-economic conditions in the Aral Sea Basin for the period 2003-2010" (ASBP-2). – Dushanbe, IFAS, 2003 – 110 p.
15. Putilov S. The planet is threatened "with grain wars". //"Novosti razvedki i contrrazvedki", 1996, # 24 – p.14.
16. Rules about "Interstate Commission for Water Coordination in Central Asia", Tashkent, 1992.
17. Statement of Chiefs of Water authorities of republics of Central Asia and Kazakhstan, Tashkent, 1991.

STRUCTURAL BARRIERS FOR FARMERS' PARTICIPATION IN DEVELOPMENT PROCESS

Ali Ghasemi[1]

ABSTRACT

Scaling up sustainable welfare of human is, no doubt, possible in development process and through mainstreaming of socio-ecological issues and alleviation of poverty within the **"global context"**.

The development process tends to changing and reforming the structures, and focuses on differential change in the fields of economy, culture and nature, however, leading to the creation of many tensions which should be recognized and controlled. Many socio-ecological uncertainties and deficiencies have posed impacts on different development strategies adopted during the past years.

Authorities believe that empowering the target beneficiaries and creating active NGOs, followed by gradual transfer of related commitments to competent people-oriented are accounted for the initial steps in structure reforming and managing improvement processes.

Investigation on participatory and farmers-based irrigation management has revealed noticeable lack of a native pattern, for which, evaluation on the reasons of success in the successful pilot as Qazvin towards removing cultural and legal obstacles and the process of extending the development program of people's participations stand and lead to "solidarity" in methodology of irrigation management transfer.

This essay highlights the following cases:

- Factors and elements of weaknesses in administration and managing structure
- Management rules and regulations involved in the area of agricultural water

Then a new scope will be presented on separation of water resources management and their utilization towards formulation of the Integrated Water Law and structural reforming of water management. It presents many applicable suggestions on method of organization, irrigation management transfer process, and promotion of productivity. At last, a new operating pattern for water supply (basin) and consumption (network) in

1- M.Sc. in Irrigation Structures, and Managing Director of Qazvin Irrigation Management Co. (QIM), & Initiator and Executive of Qazvin Participatory Irrigation Management Project. Address: Shahid Bahonar Bulvd., Qazvin, Iran. Tel: +98281-2233-187, Email: ghasemi_ali2@yahoo.com

hydraulic establishments is proposed under the title of Integrated Water management System «Inversed» tree-shape.

Key words: Water management, Water uses management, Inversed tree-shape model, Empowerment, People's participation

1. INTRUDUCTION

Huge investments are annually spent over supply and consumption of water at global scale. Such endeavors have crucial aspects in arid and semi-arid areas (as Iran) and it seems that In future, water issues remark for fundamental constraints in human society and possibly causes unwanted tensions or conflictions.

Many developing countries, have so far adopted unilateral governance in studies and implication of water and agricultural development schemes. They, usually, ignore socio-economic settings of rural communities during developmental planning. Such managerial system would eventually result in regeneration and survival of the former lord-peasant system leading to wider "nation-state" context, which nullifies people's impact on decision-making process. The consequences of this status lowers the productivity indices and generates critical challenges as: poor efficiency in modern networks' operation; pre-matured depreciation of hydraulic structures; lack of continued plan for maintenance; poor adoption of wise planting and irrigation policies; and lower farming yield per hectare under irrigation- drainage condition.

Upon the managerial view as "Re-engineering" expressed by Michel Hummer (1990), it is inevitable to emphasize on basic change and new attitudes and eradicate traditional methodologies. Under re-engineering scope, science, arts, theory and practice are interlinked to encourage beneficiaries' participation and to meet their basic requirements.

Obstacles and restrictions hampering farmers' participation can be identified through "Group Communication" and are gradually eliminated by launching integrated participation system and transferring managerial commitments. Enacting progressive codes and conducts, and merging parallel organizations would shed light on inter-relations and pave the way for multi-dimensional participation of farmers in running and maintaining hydraulic establishments.

2. METHODOLOGIES

The ongoing administrative culture and institutional set-up in water management and utilization are assumed as key variables to affect on decision-making and farmers communications. Various surveys demonstrate a strictly manager-oriented nature in governmental organizations, while in certain cases, the more "participation" intervenes, the more positive impacts are observed. Followings are success stories at global scales with impressive impacts and change in the process of service delivery and optimum running of hydraulic systems:

- Participatory Approach Program (PAP) in Philippine's National Irrigation Administration model (NIA)
- Irrigation Management Transfer (IMT) in Turkey
- Participatory Irrigation Management (PIM) in Qazvin Irrigation Management Co. (QIM) in Iran

Often, attracting consumers' attention to follow development program, is accompanied by financial mechanism and encouragement.

Emphasis on this aspect and derivation of new approaches for saving beneficiaries' cost and time in line with development of human communications and observation of cultural remarks, can greatly enhance participatory management and its objectives.

Locally-adopted and genuine approaches act as practical principles in participation development schemes. Incorporation of local clients in re-engineering of water management and the nature and quality of services rendered by the private institutions, shall effectively mobilize development process and scaling up productivity in agriculture sector.

In order to analyze public system and the sub-cultural impacts on prevailing relations between government and people, and to collect information on institutional set-up and their terms of reference, certain field surveys and direct studies were conducted on legal instruments and existing data in water sector.

Moreover, proposing key insights and evaluating impacts and performance of policy-making and implementing centers were taken into account via unstructured observation (UO) without attention to structure of existing administrational system.

3. DEVELOPMENT AND BARRIERS PARTICIPATION

Experts recognize that in a large system for supplying, conveying, distributing and utilization of water, climatic, environmental, economic and social perspectives are greatly inter-linked. Hence it calls for scientific investigation and management of such system as a holistic entity with following two operational areas:

a. Upstream geographical area including water basis, hydraulic structures, electrical and mechanical sectors of reservoir dams which are widely managed by absolute public management system.
b. Downstream geographical area including water conveying tunnel regulating and deviation dams, irrigation-drainage networks and farm inlets which are either operated under public, participatory or private management systems.

It seems that inception of IMT process under such complex status is only practical through boosting participatory management of the extremely end of the networks i.e. distributor channels. Provision of socio-technical requirement will provide reliable bed for expansion of people's participation in hydraulic segments and upon willing and request of the target clients. "Management Commitment" remarks for real success of the change–oriented plans and for development of participatory interventions. This principle is considered as an impetus and effective factor in every reforming and changing initiative. Financial planning and regulation is also recognized as another critical stage for expedition of an overall participation process. Improvement and empowerment of managerial structure of target farmers may also be realized via involvement of the work forces (IWF). This process becomes operational through creation and enhancement of NGOs followed by gradual IMT fulfillment. At present, people's participation in water utilization management and IMT process does not comply with scientific and practical criteria, leading to lack of organized short and long-term development schemes in participatory management. Moreover, ongoing measures are either hort-run and fragmented in nature, and are mainly operated for coping transient problems and possible enjoyment of credits from national or international resources. Consequently, such attempts, together with other tasks towards privatization including various examinations, studies researches and guidelines, could never pave the way for development of participatory management. Perhaps, the reasons behind failure of farmers' involvement in irrigation commitment lie within the legal gaps, parallel institutions, and lack of decisive will for strengthening creativities. Aside from legal and structural inconsistencies, there exist certain key socio-cultural challenges in the way of IMT planning and new communications development.

3.1. LAW IN GOVERNMENTAL MANAGEMENT OF WATER AND INCONSISTENCIES

In 1943, a legal status for determination of governmental rights in water sector was developed by establishment of the autonomous National Irrigation Institute (approved in 1943) as the first step for organized studying and implementing of water-soil projects. Water law and its nationalization process were also realized in line with facilitation and expedition of projects execution in hydraulic systems and free occupation of related lands under networks construction, followed by legal stabilization of governmental water. Foregoing legislation and other regulations could never create a viable bed for meeting social perspectives in national water management system. Later, removal of this inconsistency failed even upon formulation of the law for equitable distribution of water (1982) and its executive code (1996). Despite the rank of I.R. Iran among the top global dam-constructing countries, it seems no outstanding progression in irrigation management system. In this regard, the law of stabilization of agricultural water change (1990) and its segments as follows, have to be well-evaluated and interpreted: i) Traditional networks – equal to 1 % of guaranteed price of agri-crops. ii) Combined networks - equal to 2% of guaranteed price of agri-crops. iii) Modern networks - equal to 3% of guaranteed price of agri-crops. Enacting certain parts of water rules and regulations has also encountered challenges in promotion of capabilities and exploitation of the resources. The operational inconsistencies in ongoing regulations have always caused dissatisfaction of the users against executive bodies including MOE, National Water Resources Management, Regional Water Corporations, and Provincial Directorates for Water Affairs, and Provincial Irrigation Utilization Companies. However, under any circumstances where socio-economic status justifies, legislation should be frequently renewed and updated. For instance, the Law for equitable distribution of water assumed as a progressive mechanism and could affect on better interaction between the farmers and public institutions specifically in general water management, whereas the same Law, and its executive codes, has gradually lost its applicability. Followings are certain legal parts left idle or faced to limited performance:

Table1. Act for equitable water distribution ratified by Iranian Islamic Consultative Parliament in 1982

Article No.	**Description**	**Duration**
I	Removal of occupations in natural rivers, streams, channels, and ponds	Unlimited
IV	Prevention and stopping the unauthorized wells	"
XII	Installation of metering devices on existing wells	-
XXI	Transfer of agri-water distribution and fee-charging to local users	-
IXXX	Controlling and monitoring on water consumption rate	Unlimited
IXXX	Shifting the responsibilities for creation and utilization of tertiary and quarternary channels	-
IXXXV	Prohibiting any change in water intake or creating new water conduits	Unlimited

Table2. Operational regulation for optimum consumption of agri-water approved by the ministerial cabinet in 1996

Article No.	**Description**	**Enforceable in**
V	Formation of appropriate utilization systems and empowering the local leadership on water issues	2 years
VII	Issuance of due certificates for optimum agri-water consumption	-
XVI	Installation of water meter for volumetric discharge of wells	2 years

Table3. The 3rd National Development Plan ratified by the Parliament in 2000

Article No.	**Description**	**Enforceable in**
106	Creation of Water Users Associations (WUAs)	5 years
107	Creation of water and soil utilization organizations	5 years
107	Issuance of Agri-water Document	Unlimited

3.2. NON-GOVERNMENT DEVELOPMENT, REGULATIONS AND CHALLENGES

Government focuses on Article 44 of National Constitution to plan for entrusting certain affairs to the people. This Article recognizes the national economy under 3 different sectors i.e., governmental, cooperative and private, with wider commitments and involvement for non-governmental sectors.

Initial legal mechanisms for organization and registration of NGOs can be assumed in the Law of Trade (1932) as the underlying structure for promotion of commercial and production affairs in ongoing private and non-governmental sectors. Along this path, certain other regulations were also devoted to development of non-governmental management and economy, in particular, strengthening agri-based corporation. with the following frameworks:

Law of Agrarian Reforms (1961),

- Law of Production,
- Cooperatives and Land Consolidation (1970),
- Rural Cooperation Authority (1971),
- Law of Agricultural Corporation (1973),
- Law of Labor and Business Association (1990) , and
- Law for Development of Cooperation Sector (1971).

The primary measure for improvement of existing water networks utilization, accounts for creation of irrigation-drainage utilization companies. The trilateral agreement (1990) between the Ministries of Energy, Agriculture and Head of MPO, led to establishment of 17 companies at provincial level (1991) which recognized allocation of 49% water shares for the two foregoing Ministries and 51% for local users and beneficiaries (that never realized). Presently, Water Resources Management Co. deserves 51% water shares whereas, the rest lies within affiliated firms linked to Ministry of Energy. Though, power of decision-making in management systems is always affected by 3 general elements i.e., "Institutional status", "Management aspects and merits" and "Economic capabilities". However, lack of well-organized and direct relation between the NGOs' management domains underlies their poor productivity. This barrier is assumed effective enough and grows as legal gap in developing countries. Consequent of this interaction is materialized in the fundamental equation as one member=one vote, whereby for many NGOs’ managers, power originates from ownership scale i.e. wealth (economic power=one vote).

However, private firms and NGOs were, more or less, established but disappeared at certain places and periods. Today, their share in GDP is negligible with inefficient role in formation of farmers-government interactions. Followings are key reasons underlying such ineffectiveness:

Table4. Different organizations and their specifications

No.	Type of Organization	Capabilities	Risks and Deficits
1	Special corporation	+ Free competition + capital impacts	-Preference of leadership profits -Tremendous fixed and circulating capitals
2	Limited liability	+ Free competition + capital impacts	-Preference of leadership profits -Tremendous Fixed and circulating capitals
3	Agri-based corporation	+ Specialties + Govt. support	- Inappropriate background before the farmers - Demolition of registered agri-based corporations
4	Rural Cooperatives	+National participation + Govt. support	- Lack of ownership influence into management - Poor technical and executive experiences
5	Production cooperative	+National participation + Govt. support	- Lack of ownership influence into management - At least 1000 ha. Land possession compulsory
6	Water Users' Association	+Members' common benefits + Govt. support	- Lack of ownership influence into management - Only one union in every province
7	Corporate association	+ Soft regulation +Many members' interests	- New and unknown operation - Unclear legal position

In the proposed model, "Federation" accounts for the governing body over the corporate Associations at provincial level which, in turn, undergoes National Federation domain as the highest apex supervised by ILO. It is anticipated that ILO shall extend needed support and mobilization to the national federation.

3.3. DEFICITS OF THE INSTITUTIONAL STRUCTURE

Connoisseurs believe that the heavy government would obstacle the sustainable development. This is a key instruction for analysis of the related organizations and their performance in the areas of water, agriculture and environment.

During the past years, various models were experienced on the utilization of hydraulic structures e.g. reservoir or deviation dams, tunnels, conveying canals and other irrigation systems. Generating water management systems based on water catchment basin, geographical and political divisions, or entrusting the responsibility to regional or provincial water organizations, are the main public management models in water sector. These models are characterized by development of water resources while demonstrating different definitions and operations in management and consumption patterns. Regional water organizations and/ or provincial authorities have the key commitments in government-based water management system. This arrangement in combination with national hierarchical divisions, including provinces, districts, countries and villages, and with serious impacts on social, political and economic sectors, has created a traditional and non-organized management system in water sector.

Blurred and poor structure of water and agriculture management is the central factor that hinders operation and performance of the public sectors in mobilizing beneficiaries' participation. Unfortunately, there are inter-mingled borders between management and operation of water and agriculture. On the other hand, it doesn’t seem sharp distinction between water resources and their consumption, nor clear obligation yet identified for water providers and users plus lack of proportional balance realized in the areas of decision-building and decision-making.

3.4. SOCIAL AND CULTURAL CHALLENGES

Complexities and differential interactions in socio-economic and techno-engineering fields of water and agricultural management represent multi-lateral relations with positive or negative impacts. Farmers' inter-relation as well as communication of rural elites and groups with executive institutions could either promote or weaken this system. Various constraints so far detected in the process of people's participation in public and community sectors, have also been identified as other challenges. Moreover, there exist other socio-cultural bottlenecks in the various processes of NGOs development, either for local users, farming units, farming groups, farming blocks, water users' unions and/or for their apex federation.

Making proper ground for promotion of participation, inherited from conventional sub-cultures as election of local water-distributors and formulation of multi-century petitions on permanent or seasonal rivers, have all shared in consolidation of Water Users' Associations followed by Irrigation Management Transfer (IMT) to the local beneficiaries.

3.5. MISCELLANEOUS BARRIERS

Other barriers might also be considered in the development process of non-government sector including lack of transparency and synergy in public institutions, poor executive mechanism in operation, inadequate plan for reforming the system, deficit support to farmer's empowerment schemes, imbalance of funds and costs, limitation of entrusted responsibilities, and lack of needed incentives for holding new commitments.

Despite the numerous researches and studies made in the areas of utilization system and people's participation of irrigation-drainage systems, examinations are designed as centralized trend with no local and operational perspectives. Hence, unilateral resolution of governmental obstacles in decision-making processes and implementing of non-process-oriented programs were taken into account with no focus on people's participation. This means that beneficiaries are not briefed on the requirements and impacts of IMT process in future.

Negligence of training programs for empowering the associations towards programming, organizing and solution of technical and legal problems geared in water management system, and the way for interaction and perception of how to distribute responsibilities between associations and government, are assumed as other inconsistencies.

There are other uncertainties as; lack of regulatory codes for outlining needed guidelines in government sector and for its better interaction with local users; poor policy-making and transparent action-plan in formulating appropriate agreements; and inadequate coordination in development of self-running ground, would hinder the real motivations for shaping participatory management and people's mobilization towards holding new commitments. Moreover, owing to poor development of IMT initiative, changing the national or local managers and authorities has sometimes changed the scenario, or in cases, led to abruption of transfer process, too.

4. CONCLUTION

Productivity is know as a knowledge for sound exploitation of resources, human forces, skills, technology and information, and for gaining the best outputs and "Integarated management in consumption". Good productivity and provision of prompt means for NGOs management, particularly in water distribution and for beneficiaries' affairs, would realize their satisfaction. It seems, upon proper designation and operation of an integrated management system comprising of two components i.e. network utilization management (Water Supply in the Catchment basin), and observation of water consumers' priorities, many challenges can be eradicated with remarkable leaps towards higher productivity. However, integrated management system basically regards other perspectives and features in "socio-technical management of surface and sub-surface water" which resembles a tree-like model and concentrates on water as the critical element of productivity in agriculture for maximum reduction of users' costs and times.

The IMT initiative has started with setting and development of water user's organizations followed by training qualified managers and renovation of managerial structures in basic establishments. Legislation of government and NGOs’ codes and conducts, as well as gradual transfer of networks management entail due change and reform of regulations in monitoring and in executive bodies at local and national scales. certain recommendations for more clarification are as the following:

4.1. FORMULATION OF "INTEGRATED WATER LAW"

For the sake of sustainability and transparency, the task calls for adoption of comprehensive laws and regulation to form related organizations and transfer of irrigation management (IMT) in favor of the local clients. This holistic law would outline all stakeholders and their commitments towards improved proceeding of the initiative through extension of participation-focused culture and empowerment of the target beneficiaries. The law would clarify terms of reference, for the executive water authorities issues:

Table5. Topics and contents of the proposed "Integrated Water Law

Chapter I: Generals		
Section	**Description**	**Remarks**
1	Introduction	Background and justifications
2	Terminologies	Looking up the national and historical encyclopedia
Chapter II: General Regulations		
Section	**Description**	**Remarks**
1	Studies on water resources	Details and aspects
2	Water basins	General divisions and specifications
3	Artificial infiltration & recharge	Water catchment's conservation
4	Flood plains and traditional streams	Coordination with related institutions
5	Water resources conservation	Surface and sub-surface water
6	Quarries	Ways of aggregate utilization
7	River bed and banks	Description of scientific methods for location of beds and banks
8	Violation and offences	In coordination with Judicial power
9	Beneficiaries affairs	TOR and operational guidelines
10	Investment	Local and external investment
11	Codes and conducts	Live institutions, executive codes and conducts
12	Water allocation	Micro and Macro Allocations
13	Water rate	Details on total cost
Chapter III: Headquarters		
Section	**Sectors**	**Remarks**
1	Ministry of Energy	Office of the Minister
2	Dept. of Water Resources	Mission and Vision
3	Dept. of Water Use	Mission and Vision
4	Company of Water Resources Management	"
5	National Water and Sewage Company	"
6	National Irrigation-Drainage Company	"
Chapter IV: Provincial Executive Bodies		
1	Provincial water management authority	Vision and Mission
2	Provincial water and Sewage Authority	Vision and Mission
3	Provincial irrigation and drainage company	Vision and Mission
Chapter V: Development of People's Participation		
Section	**Description**	**Remarks**
1	General aspects and definitions	History, operational trend
2	WUAs mission	Bylaws, ToR
3	Central federation at provincial level	"
4	National Union of WUAs	"

4.2. REFORMATION OF WATER MANAGEMENT SYSTEM

Ratification of the "IWL", hopefully leads to duty distinction of water supply and demand divisions, which in turn, paves the way for enhanced water management system. To this end, following structure is proposed for the system concerned:

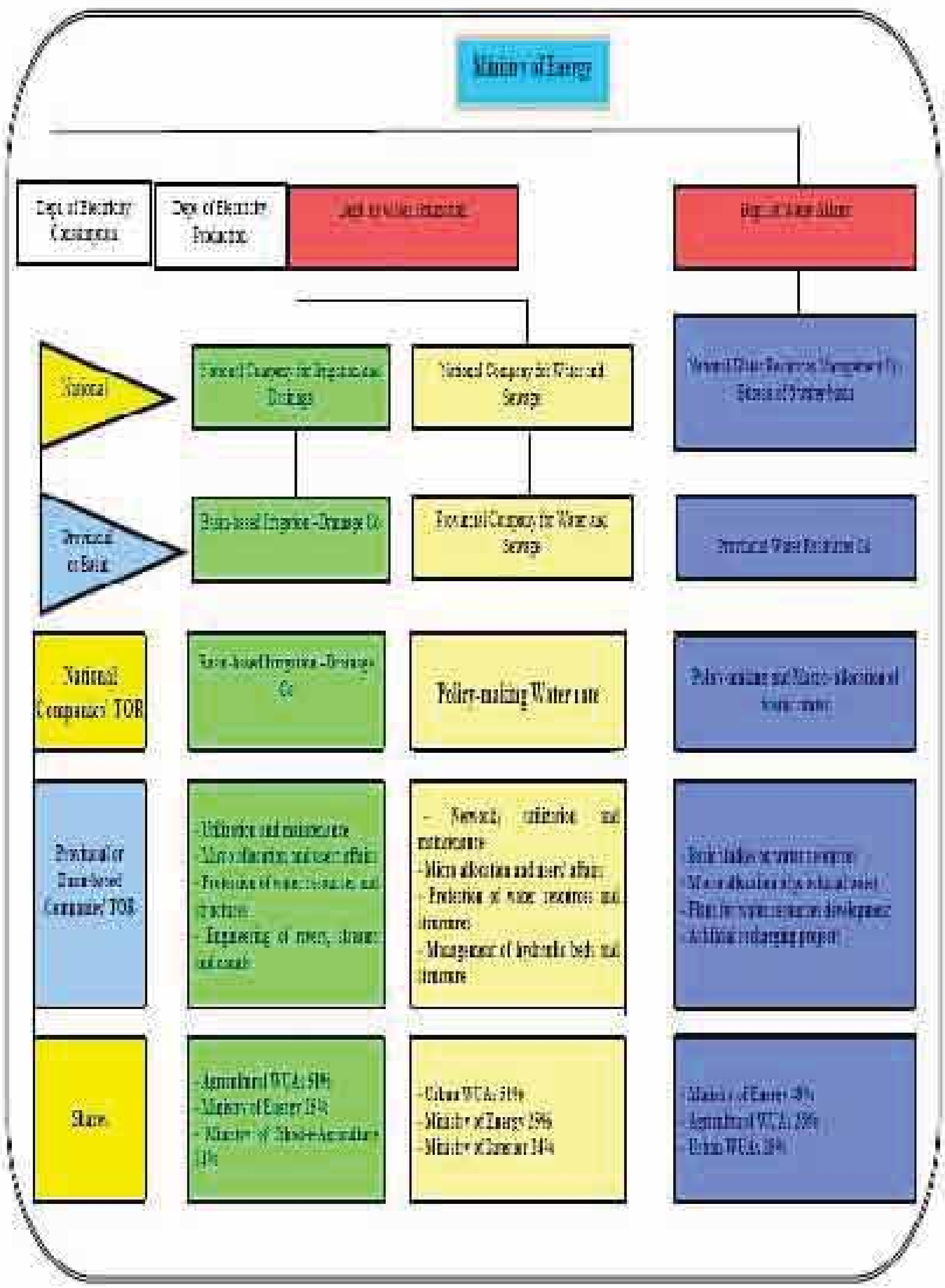


Diagram1. Proposed Water Management System

4.3. WATER RATE

At present, water rate is calculated upon percentage of agri-crops price, however, it does not match general costs for supply and distribution of agricultural water. Based on investigations, this unconformity has significantly affected the irrigation performance, which means the real and natural value of water deserves negligible impact on productivity. Hence, it is suggested to calculate the water rate on the basis of projects' operation total costs and their hydraulic structure.

4.4. INTEGRATED WATER MANAGEMENT (IWM)

Integrated Water Management is closely involved in water supply under natural conditions, and in its distribution through technical codes and socio-cultural structures. Obviously, under such status, manifold utilization system and its negative impacts, tend to suppress any improvement management and creativity. Therefore, it is rational to appeal for replacement of the manifold and dispersive management by an integrated management system on all water establishments. To this end, the following inversed tree-shaped model is proposed to run for a 2-year trial in pilot regions:

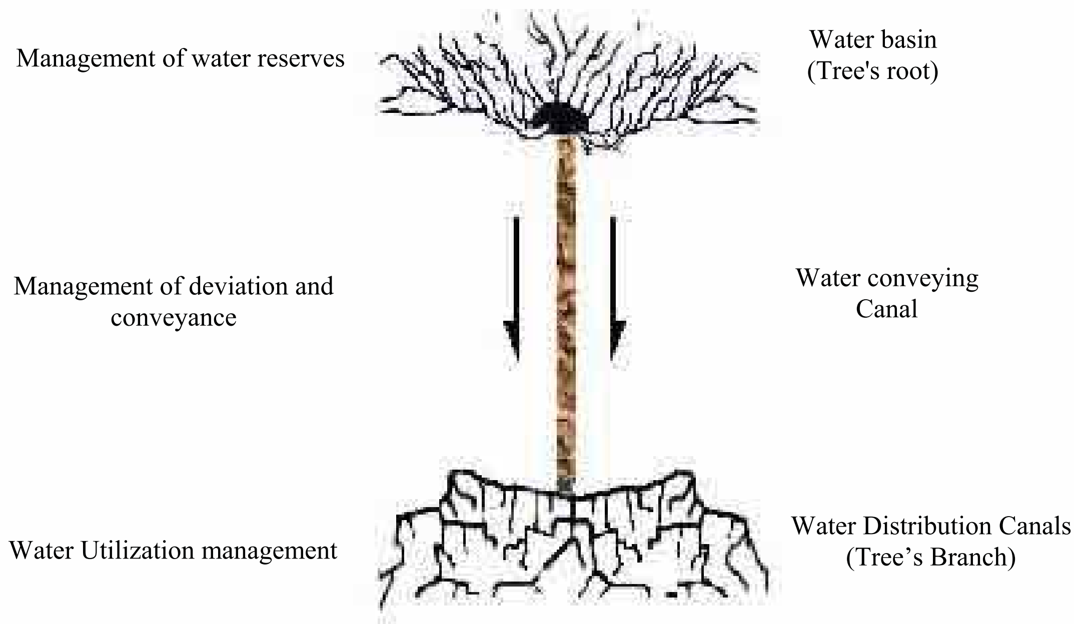


Diagram2. Integrated Water Management Inversed tree-shaped model (I)

To make this model operational, we can mobilize the existing irrigation-drainage companies or create companies for water establishments operation. This model comprises of management for utilization, supervision of all segments (basin and network) under integrated manner.

These companies would bear vision and mission in water supply (basin) as the model roots, and in utilization sector (network) as the branches of the inversed tree-shaped model. As far as institutional chart is concerned, utilization management will enjoy autonomous operation and recognition by other managerial structures as regional or provincial organizations for water resources management with no direct intervention in it. Consequently, the foregoing model, if becomes operational, shall lead to the following achievements:

- Policy-making and macro-allocation of basin's water: (absolutely) by government;
- Integrated planning and management on the system: (just) by utilizing companies;
- Launching utilization management and improvement of water management: (only) by Water Users' Associations.

5. REFRENCES

1. Archives of the Irrigation-Drainage management Co. Qazvin province.
2. Bayani P , ofrecio , Participatory Development and Management : A Cornerstone of Philippine Irrigation Program , Tsukuba Asian Seminar , Japan , NOV 80014 (2005)
3. Dennis kinlaw, 1995, the practice of empowerment; Marking the Most of human competence, England.
4. Ghasemi, Ali. (2005). Participative Management in Qazvin plain , icid , china
5. Green, B, and Barry, j, "the participation Solution, Management Review. November 36-39 " 1985
6. Hatami, Abbas (2002), Change-oriented Organizations and Development-focused companies, Hamed publication, Zanjan, I.R. Iran
7. Heydarian, Ahmad (2004), "An analysis on domestic experience in IMT", Goharane-Kavir, Irrigation-Drainage Co. of Tehran, I.R. Ira.
8. Kinla, Denis, "Human Resource Development", translated by Dr. Nejad Parizi (2004), Modiran publication.
9. Lectures and essays of conference« Participation System » , (2000) Ministry of Oil Publication , Iran
10. Maxvel Maltz (1985), "Psychology of Subjective Picture", translated by Mehdi Qarachedaghi, Nobahar publication, Tehran, I.R. Iran.
11. Mohsenian, mahdi, Proceedings on Participation Approach (2001), Human Communication, Soroush publication, Tehran, I.R. Iran.
12. Rabbani, Masoud-Rezaie, Kamran-Maanavizadeh, Neda and Ebadian, Mahmoud (2006), "Pure production", RWTUV Co. Iran, Atena publication.
13. Shafiabadi, Abdollah (1987), "Techniques and Approaches in Consultancy" Rose publication, Tehran.

FARMERS' TENDENCIES TOWARD PARTICIPATORY IRRIGATION MANAGEMENT

Nasren Afshar[1], Kiumars Zarafshani [2]

ABSTRACT

In most developing countries, irrigation management is heavily dominated by the public sector. However, government operated irrigation schemes are poorly maintained with steadily deteriorating infrastructure. A current solution to this dilemma is participatory irrigation management (PIM). This participatory approach seeks to share the burden of irrigation operation and maintenance cost with the beneficiaries. For any participatory approach to be effective, qualitative studies are needed to assess how beneficiaries think about the outcome of such projects. Therefore, the purpose of this qualitative study was to assess farmers' tendencies towards participatory irrigation management among members of Sarabbas and Sefidbarg Water Users Association (WUA in Kermanshah province. Using focus group techniques among 103 members, results indicated that farmers have somewhat weak tendencies toward PIM. They felt that farmers can not share the cost of irrigation facilities and the current facilities are out-of-date. Further, they were not interested to install water meters and applying for loan was against their religious beliefs. Although farmers were willing to solve water problems among themselves, but they believed irrigation operation and maintenance should be the responsibility of government agencies.

INTRODUCTION

Almost 40% of the world's food crops are produced by irrigated agriculture. Thus, the performance of irrigated and drainage is critical to the food supply and to farmers' income, as well as to the environment. The ultimate goals in managing irrigation water are efficiency, equity and sustainability (Sun, 2000). Efficiency has been achieved if every drop of water has been properly allocated and used without any waste. The goal of equity means that water is fairly distributed among users. Some farmers may have an advantage over others. Those at the head of a canal have an advantage over those living downstream, as they have first access to water. Influential farmers may have better

1- Graduate Student, Department of Agricultural Extention and Education, College of Agriculture Razi University, Kermanshah, Iran, TEL: (0831) 8323732
2- Assistant Professor, Department of Agricultural Extention and Education,College of Agriculture, Razi University, Kermanshah, Iran ,TEL: (0831) 8323732

access to water than poor farmers. In some cases, ideals of efficiency and equity may be in conflict. The goal of sustainability, therefore means that the users of today should maintain the quality and quantity of water resources for the use of future generations (Sun, 2000).

Managing irrigation so as to achieve efficiency, equity and sustainability is very difficult. Market mechanisms are not enough and high prices for water when it is scarcest mean that low-income users may lose their access to water. Unrestricted use if prices are low may lead to pollution, water-logging and over-use of groundwater. Given the special characteristics of irrigation water, there is a good reason for government to intervene, and even directly manage irrigation systems. However, when a centralized agency is in charge of planning and operating an irrigation system, the result is often too much bureaucracy. Moreover, too much money is spent on staff salaries and as a result, the cost of water is high with poor irrigation service, and yet the users are unwilling to pay their irrigation fees. The result is a vicious circle of high costs, poor services and low payment of fees, leading to inadequate funding and further deterioration of services.

One way out of this difficult situation is the participatory approach to irrigation management. Increased farmer participation in irrigation is part of a world-wide trend of devolution in natural resource management. Experience shows that farmers all over the world are potential managers who, when properly organized, are able to manage their own affairs. Participatory irrigation management (PIM) is increasingly viewed as a means to improve the performance of irrigation investments. Beginning in the 1980s, there have been large-scale programs to turn over irrigation management from government agencies to organized water user groups in a number of countries, such as the Philippines, Indonesia, Senegal, Madagascar, Colombia, and Mexico.

The idea that farmers should participate in irrigation management has grown in Iran since the mid-1980s. The premise is that when farmers are clearly the owners of the physical system, so that the maintenance costs are their own responsibility, they will have a strong incentive to protect the physical integrity of the system to reduce their overall costs. Moreover, PIM has been driven by the need for a higher return from the massive funds invested in irrigation, which plays a major role in increasing agricultural production. However, in western part of Iran, these irrigation systems exist in isolation with limited participation of farmers. The purpose of this qualitative study was to shed light on farmers' perception towards participatory irrigation management in Kermanshah province.

PURPOSE AND OBJECTIVES:

The purpose of this study was to assess farmers' perceptions toward participatory irrigation management. Specifically, the study sought to identify PIM issues fram farmers using nominal group technique.

METHODS AND PROCEDURES:

This qualitative effort used a focus group approach to meet the objectives of the study. Interview questions for focus group leaders were designed to gain an understanding of the issues facing farmers, as experienced by each of the respective groups of individuals composing the focus group. Farmers were asked to respond to four open-ended questions regarding their perceptions toward participatory irrigation management. The questions were: 1) what do you think about participatory irrigation management? 2) what do you think the major obstacles are in operating and maintaining irrigation systems? 3) What are the problems with installing measuring devices? 4) Would you apply for a loan in order to develop irrigation systems?

Focus group were composed of farmer (n = 103). The nominal group technique (Delbecq, Van de Van & Gustafson,1975) was used to facilitate the identification of problems facing participatory irrigation management among farmers, followed by discussion sessions. The nominal group technique is done only when group consensus regarding the prioritization of issues is important to the overall research or planning project. The nominal group technique can be used as an alternative to both the focus group and Delphi techniques. It presents more structure than the focus group, but still takes advantage of the synergy created b group participants. As its name suggests, the nominal group technique is only "nominally" a group, since the ranking are provided on an individual basis. Focused group sessions ranged from 3-5 hours in length and were facilitated by researchers. At the conclusion of each session, notes were transcribed and summarized into tables with frequencies and percentages.

RESULTS:

The first research question assessed farmers' perceptions toward participatory irrigation management. As shown in table1, the majority of farmers (43.7%) perceived PIM as creating extra burden or obligation on farmers. However, 21.3% of participants perceived PIM as autonomy among users. Moreover, 25.2% of farmers believed PIM is not possible since water users don't get along well with each other and it would create communication problems among farmers.

Table 1. What do you think about PIM?

Answer	Frequency	Percentage
Develops financial obligation for farmers	45	43.7
Not possible considering current communication problems among users	26	25.2
Provides autonomy among users	22	21.3
Develops sense of responsibility	6	5.8
Government agencies are unable to manage irrigation systems.	4	3.9

The second research question assessed major obstacles in operating and maintaining irrigation systems as perceived by farmers. Results indicated (table 2), the majority of farmers believed the irrigation facilities are out of date and a frequent electricity shortage creates more problems for farmers.

Table 2. what do you think the major obstacles are in operating and maintaining irrigation systems?

Answer	Frequency	Percentage
Irrigation facilities are out -of- date	54	52
Frequent electricity shortage	25	24
Irrigation facilities have no problems	18	17
I have no knowledge of facilities maintenance	6	5.8

The third research question asked farmers to what extend installing measuring devices cause problems. As shown in Table 3 the majority of users were against such installation due to high cost and complicated maintenance problems.

Table 3. what are the problems with installing measuring devices?

Answer	Frequency	Percentage
The majority of users are not willing to install measuring devices	44	42.7
Too expensive	26	25.2
Complicated maintenance problems	11	10.6
It should became mandatory	6	5.8
Unreliable water resources	2	1.9
I have no knowledge of install measuring devices	5	4.8
It doesn't help much	3	2.9
Having to pay water fee limits installing measuring devices	3	2.9
There is no problem installing measuring devices	3	2.9

Finally, the fourth research question assessed farmers' willingness to apply for loans in order to develop irrigation systems. Results revealed that the majority of farmers are against loans due to religious beliefs. However 40.7% of farmers were interested to apply for a loan (table 4).

Table 4. Would you apply for a loan in order to develop irrigation systems?

Answer	Frequency	Percentage
Receiving loans is against religious belief	50	48.5
I would use loans to expand irrigation systems	42	40.7
I can not pay back the loan	9	8.7
Don't need a loan, I have sufficient financial resources	2	1.9

Data was further content analyzed to evaluate farmers overall perception towards participatory irrigation management. Using 3-point Likert Scale, farmers were asked to respond to 12 statement concerning their level of agreement toward participatory irrigation management practices, As shown in Table 5, farmers were less inclined

to participate in irrigation management schemes launched by government officials.

Almost all farmers (99%) believed irrigation system management is the responsibility of government agencies.

Table 5. Farmers' perception toward participatory irrigation management.

Answer		agree	somewhat agree	disagree
Management of irrigation systems is governments' responsibility	Frequency	102	1	0
	Percent	99	1	0
Irrigation facilities belong to the government agency	Frequency	100	1	2
	Percent	97	1	2
User are able to manage irrigation systems	Frequency	5	13	85
	Percent	4.8	12.6	82.5
Efficiency of irrigation systems will increase if users take the responsibility	Frequency	6	8	89
	Percent	5.8	7.7	86.4
Government is doing a good job in managing irrigation facilities	Frequency	26	2	75
	Percent	25.2	2	72.8
There is problem with water distribution among users	Frequency	95	2	6
	Percent	92.2	2	5.8
Users should pay water fee	Frequency	39	15	49
	Percent	37.8	14.5	47.5
Users should maintain and operate irrigation systems	Frequency	21	15	67
	Percent	20.3	14.6	65
Users should repair irrigation systems	Frequency	4	5	94
	Percent	4	4.8	91.2
Users should take charge of water distribution	Frequency	21	31	51
	Percent	20.3	30	49.5
Users should take the responsibility of solving water problem themselves	Frequency	56	22	25
	Percent	54.4	21.3	24.3
Users should pay for the cost of irrigation water	Frequency	3	3	97
	Percent	3	3	94

CONCLUSIONS, DISCUSSIONS AND RECOMMENDATIONS:

Members of Sarabbas and Sefidbarg Water User Associations were not enthusiastic

about participatory in irrigation system management promoted by government.

They believed these facilities belong to the government and they should take a passive role in managing such facilities.

One reason for current perception is that government have not yet provided an up- to-date infrastructure thus farmers feel threatened by worn out irrigation facilities. They feel these facilities would be expensive to maintain and that their resources are not sufficient to meet the cost of operating and maintaining these facilities. Furthermore, farmers were less interested

to work in groups. Based on the results of this qualitative study, it is recommended that government agency take a first step in turning over irrigation facilities that are sound and without any mis-function. It is further recommended that government officials select those

places with highly motivated farmers to participate in their irrigation schemes. More resourceful farmers are more inclined to participate in irrigation management. Therefore, government agencies should target more resourceful farmers if they are to enhance participatory irrigation management projects.

REFERENCES:

1. Delbecq, A., Van de Ven, A. H., and Gustafson, D.H. Group Techniques for Program Planning. Glenview, IL: The Scott, Foresman and Company, 1975.
2. Sun, P. P. C. (2000). Participatory Irrigation Mangaement (PIM). Retrieved on 12 Dec. 2006: http://www.Agent.org/library/abstract/nc129c.html

SOCIO-CULTURAL INTIMIDATION ON THE EMERGING IRRIGATION INSTITUTIONS

P. Ignatius Prabhakar[1]

India is predominantly an agrarian society; access to water for irrigation is an influencing factor of the status of a landed individual. Technological development provided opportunity to individual access to ground water through mechanised wells and hence the once popular tank water irrigation lost its importance in many places and so the traditional irrigation institutions managing them. The State had full control over irrigation tanks. The last decades of the 20th century witnessed a pervasive policy consensus spear headed by World Bank to transfer state management of natural resource by and large to community of users. Resulting in a blanket approach of Participatory Irrigation Management (PIM) components in all irrigation-related activities nationwide (Hooja *et al.* 2002). Thus through projects and through legislations the States started the formation of WUA in villages

The fundamental features of an Indian village social structure are the constitution of various castes in the village (Srinivas 1976; Béteille 1996). The interactions and relationship of individuals between local institutions of social, religious, economic and political nature underlies the functioning of village social system. An individual has different types of roles to play. The inter-relation between individuals belonging to different institutions is one of the factors that explains their role, relationship of power and social status. The power in an Indian village is spread wider in different levels of the social structure resulting in emergence of different types of elites. The elites' intervening factors play a significant role in all sets of action pattern involving individuals from different institutions.

The elites of the dominant castes held various positions in the villages' traditional institutions like the temple management and maintenance, caste organization, traditional irrigation institutions. In regard to the traditional irrigation institutions in the state of Tamil Nadu, a system of management had been in practice for several centuries called *Kudimarath*, where the farmers were involved in the maintenance of the tank for themselves. In most of the cases during the 18th and early 19th centuries due to various reasons such as local wars, appropriation of tanks by the British government, etc. the farmers slowly lost their interest in *Kudimarath*. Nevertheless, in many places farmers

1 - Researcher (Social Anthropology), Social Water Management Program, French Institute of Pondicherry, Pondicherry, South India.

continue to participate, at least through voluntary labour not under any formal discipline. (Palanisamy et el, 2003).

The competitiveness between caste groups though prevails, the entities within castes like the kin groups and lineage patronization is emerging. Another major factor that is contributing substantially in the present day village affairs is the intrusion of the popular political parties. This is manifested in various forms, like the disputes and conflicts between the families, kin groups and lineages is nourished by the rival political parties taking their either of the sides, resulting in fractious situations. The creation of WUA and TA is not an exception in the villages that has provided ample space to exercise the fuel the differences that prevails.

The state has stereotype guidelines for forming these new associations. In many instances the farmers find it difficult in adapting to the implemented association, as it does not suit their already existing system thus causing disinterest among the irrigators. As a result the formed WUAs remain non-functional. This is well explained by Mollinga (2001) in the case of WUA in Andhra Pradesh (AP), where no further action has been taken to shape processes within the WUAs apart from the organisation of the elections, and also he criticises how these newly formed associations are captured by the local elites. This viewpoint is also shared by Reddy (2005) who recently had undertaken an extensive study in AP and argue for a restructuring and reforming of the State irrigation department and the bureaucracy that is critical for effective and sustainable irrigation institutions. And Mosse (1999) in mentioning about the Tamil society he says "social dominance does not remain unchallenged by new institutions which also provide the means to advance externally defined development objectives such as equity democracy and social justice…. the point is that these social changes intersect with local caste conflicts or factional affiliation and with strategies to challenge as well as retain caste power."

In this paper I present two cases of one each from the states of Pondicherry and Tamil Nadu. In the first case I will be describing the functioning of the Tank Association of Vadanur Tank in Pondicherry, where the context is one association, one tank and two villages. The case in Tamil Nadu is about the Tank water users association of Thiruvennainallur and Saravanapakkam under the context of one association, two tanks and two villages. From these two cases an attempt is made to analyse the socio-cultural factors, such as the existing polity in the caste groups and kin groups that are intimidating the functioning of the WUA /TA and the role of the state.

AN OVERVIEW OF THE STUDY REGIONS

Tamil Nadu with a geographical area of 13 million hectares is ranked eleventh in size among the Indian States. The net area irrigated rose from 21.11 lakh hectare in 1950's to 27.75 lakh hectare in the 1990s and is reported to have come down to 21.48 lakh hectare during 2004-05. The State is dependent on the ground water resources for providing irrigation to additional acreage and to stabilize the existing area under irrigation. The three main sources of irrigation in the State are rivers, tanks and wells. There are 39,202 tanks, 2,322 irrigation main canals & 18,26,906 irrigation wells in the State. There are 79 reservoirs with a total capacity of about 6895 MCM (243 TMC) (15% of the annual water potential) (SPC, annual plan, 2005-06). The Public Works Department of Tamil Nadu have the control over the tanks that has a command area of more than 40 ha that is 8,903 in numbers. There are 20, 413 tanks that have a command area of 40 ha and less fall under the control of Panchayat Union[1]. There are 9,886 tanks called the Ex-zamin tank. Individual local chiefs called Zamindars once controlled these tanks. With period government orders, the PWD are entrusted to undertake repair works in these tanks.

Pondicherry is a small state with a geographical area of 480 sq kms that has the status of the Union Territory. Pondicherry has four regions (or districts), Pondicherry, Karaikal, Mahe and Yanam. Pondicherry and Karaikal are situated within the state of Tamil Nadu, whereas Mahe and Yanam are situated within the states of KeraIa and Andhra Pradesh respectively. The net area irrigation in the state of Pondicherry is 16.73 thousand hectare in 2003-04 [2]. Two rivers that originate in Tamil Nadu – the Gingee and the Pennaiyar – pass through the region of Pondicherry that flows into the Bay of Bengal. There are also 84 tanks that have the capacity to store water for irrigation. The region has substantial quantities of groundwater of fairly good quality. In Pondicherry, unlike Tamil Nadu, all the tanks – whatever their sizes – are under the control of PWD. There are 59 system tanks and 25 non system tanks in Pondicherry region that irrigated a command area of 6592 ha.

The study tanks are situated in Pondicherry and Tamil Nadu. In Pondicherry it is Vadanur tank and in Tamil Nadu there are two study tanks - Thiruvennainallur tank and Saravanapakkam tank - situated in the district of Villupuram. All the three study tanks receive water from the same source of pennaiyar river through two different systems. this river runs to a length of 432 km, that originates from Karnataka state that is situated to the north east of Tamil Nadu. The length of 320 km is in Tamil Nadu. The tirukoilur anaicut is siutuated across river pennaiyar in Villupuram district of Tamil nadu. There are four canals taking from right bank of the anaicut and one canal from left bank. the Vadanur tank situated in Pondicherry is the last tank that receives water from the only canal situated at the left bank of the anaicut called the Pambai canal, whose length is 32.4km and supplies water for 26 tanks. And the tanks of tiruvennainallur and saravanapakkam recieves from one of the four canals sitiuated at the right bank of the anaicut called Ragavan canal with a length of 36.4 km. These two tanks are the 16th and 17th tanks of the 46 tanks that receives water from this canal.

The Tamil Nadu farmers' management of irrigations systems act – 2000 of the Tamil Nadu Legislative assembly received the assent of the President on the 25th February 2001. The act is to provide for farmers' participation in the management of irrigations systems. And since then the government through he PWD is forming WUA in a phased manner through out the states. Even prior to this intervention from the government during mid-1990s there were projects of tank development and rehabilitation sponsored by European Commission, that introduced WUA in selected villages in the state. The Tank Rehabilitation Project of Pondicherry (TRPP) was launched in August 1999; the Pondicherry public works department (PWD) implemented this project with the assistance of the Agriculture Department. The European Commission provided

1- Panchayat Union is an administration division below the district. This panchayat union comprises of few village panchayat (see foot note no. 2)

2- http://www.pon.nic.in/stategovt/ecostat/ecostat2/ecostat.htm consultancy to assist the implementation of the project. The monetary support for the project was 81% from European Commission, 13% from PWD and 6% from the contributions of the Local community. NGOs were involved to mobilize the community and form TAs.

CASE I – TANK ASSOCIATION OF VADANUR TANK

The two hamlet villages of Purana Singu Palayam (PSP) and Vadanur (VAD) constitute the administrative unit of Vadanur village panchayat[1]. These two villages share one irrigation tank – Vadanur tank (VAD tank). Farmers from both the villages have their lands in the command area of the tank. In VAD there is a colony inhabited by the *Parayar* who are SC[2] community, majority of them are landless agricultural labourers and only few family own land. Majority of the inhabitants in VAD are from the caste of *Vanniar* (initially agricultural labourer and now farmers) who are also called *Gounder*, they hold the maximum of the lands. There are *Chettiar* (merchants by tradition, but also own lands and practice agriculture) and other castes like *Reddiar* (agriculturists and big land owners), *Yegali* (washer-man), *Pillai* (accountants) but fewer in numbers and few Muslim families. PSP also has a SC colony inhabited by *Parayar* with similar occupational pattern of that of VAD. There are few families of the dominant caste of *Reddiar,* most of them are big land owners in PSP. The majority of the inhabitants of the village are the *Vanniars* who own lands. There are other castes, *Yegali* (washer-man), *Achari* (carpenter, black smiths), *Yadava* (sheep/cattle herders) and only one *Pillai* family who were once the only big landlord in PSP.

The tank of VAD is the last tank of a system that receives water from a canal connecting the *Penniyar* river through diversion barrage controlled by the PWD of Tamil Nadu. The command area (*ayacut*) of the Tank is 165 hectares, until early 1970 the only *Pillai* family in PSP who owned nearly half of the command area. The tank has five sluices, of which through four sluices water will be distributed to the lands in PSP and through one sluice to VAD lands. The major crops that are cultivated in the command area are paddy and sugarcane. Paddy is cultivated for three *bogums* (cropping season), one is a long term crop for 5-6 months and the other two are short term crops of three months.

In hamlet village of VAD, there are ten village leaders who are called *natamai*, the preponderant caste are the *Vanniar*. The main function of this institution is to organize village temple festival. In the SC colony there are three *natamais*. In PSP again the *Vanniar* who are the majority is divided into four lineages or *kothu*. Each kothu has a leader called *kothukarar*. The function of this institution is also to organize village temple festival. Of the four *kothu* the families belonging to one of the *kothu* called the *kumalamuttar* draw respect from other *kothus*, as they were traditional leading the other three *kothus*, moreover they were one who were holding land in PSP amongst the *Vanniars* for many generations though not equal with the big land lords of *Reddiar*.

1- Village panchayat is the lowest elected governing body, administrative boundaries of a village panchayat will comprise of one or many hamlet villages or revenue villages.

2- Schedule Caste (SC) is the constitutional category given to dalits who are at the lower level of the Hindu caste hierarchy, who were also called harijans or untouchables.

In PSP rivalry between two *kothus* prevails for more than five generation. There is said to be opposition from *sanasimuttar* (one of the *kothu)* against any decisions taken in the village by leaders of *kumalamuttar*. This rivalry in many cases has resulted in clashes in the village. In the present day situation, the village panchayat president, office bearers in the TA, belong to the *kothu* of *kumalamuttar*. The leading persons of *kumalamuttar* are also member of the regional political parties and also those leading persons of *sanasimuttar* are also active members of the regional parties those opposes the political parties to which the *kumalamuttar* are affiliated.

The leading persons of *kumalamuttar* and *Reddiars* who are big land lords have good relationship with each other. Moreover, these families hold most of the land in the *ayacut* of the tank than others in PSP. Few of the leading person of *kumalamuttar* along with few interested *Reddiars* of PSP and few interested farmers from VAD took the initiatives every year to march in the supply canal upstream to see to it there is free flow of water to VAD when water is released in the system. This activity is said to be a very old practice and is termed as 'bringing water to the tank'. Due to the proportion of land holding between the farmers of VAD and PSP in the *ayacut,* the people of PSP outnumber those of VAD in participating in bringing water to the tank. The expense for this activity is met by the funds with the *kothukarrars* of PSP that are collected for the temple festivals. The revenue that is generated out of the resources from the tank like the fish is shared in the proportion of 2:1 between PSP and VAD. This is justified as one share each for the PSP and VAD; and the other share is for the water that is brought also goes to PSP because the expenses are borne by them.

An association was started during 1995 for VAD tank, under guidance of the PWD. But the association did not become active rather it remained only in paper. The only activity done collectively by the likeminded and interested farmers of PSP and VAD is bringing water to the tank when the water is released in the system, that was claimed as the most important activity. This was not done under the aegis of the association formed.

The leading person of PSP and VAD on knowing the inception of a Tank Rehabilitation Project of Pondicherry (TRPP) during 1999 voluntarily represented themselves to the project management unit and invited them to implement the project. TRPP had guidelines and procedures drafted for the formation of the TA. An NGO was entrusted with the assignment of social mobilisation and formation of TA. The NGO undertook household survey and based on it a category of members to be appointed in the Executive Committee (EC) was prepared beforehand. *Ayacut* farmers, (60%), agricultural labourers/landless (30%), other groups (washer (wo)men, shepherds, fisher (wo)men, etc) (10%). In the group of *ayacut* farmers, different categories like marginal, small and big farmer; and those with and without well had to be represented. Also women should have at least one-third representation in the EC.

The process of formation of the VAD TA was said to be difficult both for the NGO and for the leading people of PSP and VAD who had interest in the irrigation tank. The main opposition had come from the encroachers who were cultivating inside the tank. This issue was taken up rigorously by leading persons of the *saniathanmodu* of PSP to oppose the eviction of the encroachment. The representative of the NGO was manhandled, and four of the people involved with the TA were tied up inside a temple in VAD. The political and social status of those leading persons of PSP and their approach in dealing with the agitation is said to be a vital factor in the formation of the TA.

In 2001 March the Vadanur tank association was formed. It has 25 executive member of all the categories specified in the guidelines. Fourteen of them are from PSP of them four are *Reddiars* and nine are *Vanniars* mostly belonging to *kumalamuttarmodu*, nine out of ten of them from the VAD are *Vanniars* and one from another neighbouring village, who has land in the command area of the tank. One SC and two women from VAD; and one SC and one woman from PSP also comprise the EC. The president and secretary of the TA are from the *kumalamuttarmodu* and the secretary is a *Reddiar,* all three from PSP. The vice president, and joint secretaries are from VAD. The Office bearers from PSP are still continuing office, whereas from VAD changes had occurred; on formation of the TA, a Muslim was the vice-president and a *Vanniar* was the joint secretary, on due course, as their participation in the meeting and other activities was not effective, a land owning *Chettiar* and another *Vanniar* were replaced respectively.

The treasurer of the TA is a wealthy *Reddiar* and is called by the villagers as auditor; moreover he owns the biggest rice mill in the region. He has good connection with the political leaders of the state. He is an influential person and have undertaken many activities in the common interest of PSP, like, providing rice to landless at times of natural calamities, conducting health camps in the village and provided nourishments to the school children. The president of the TA is also the village panchayat president, who has been in this post for nearly fifteen years. The secretary also a local leader of the regional political party, and has served as president of the agricultural co-operative society in the village. The vice president a *Chettiar* from VAD is a big landowner; he is one of the ten *natamais* in VAD and a local leader of a regional political party. The Join secretary is also an active member of a political party.

The influential status of the Office bearers of the VAD TA has facilitated the association to undertake rehabilitation activities in the tank. They have been regularly de-silting the tank; they have laid farm roads in the *ayacut,* and riverbanks. They have also taken initiatives and planted trees in the tank bed.

Prior to the formation of TA, the resources in the VAD tank, fishes and the trees in the tank bund were shared between the villages of VAD and PSP. There is a physical demarcation in the tank that divides the tank for VAD and PSP. The revenue generated from fallen trees and from the yield of the trees in the tank bund under respective boundaries would be managed by the respective village institutions of *natamai* and *kothukarar*. In regard to the fish harvest, traditionally there was pre-defined share allocation amongst the *ayacut* farmers and as well few days of free catch for all the villagers. After the formation of TA, the TA took the control over these resources. The revenue generated from these resources went to the TA. The fish was cultured by the TA and was auctioned. This happened twice after the formation of TA, thereby depriving the earlier shares and free catch. The TA appropriates the revenue to their account that is generated from the resources in the tank that went to the village institutions earlier. This has created a frigid situation between VAD and PSP. The contention of the VAD people is that the revenue that used to come to their village institution has stopped. The people of VAD view that the revenue goes to PSP due to the domination of the office bearers of TA who are from PSP.

Ever since the formation of TA there are cold differences between the encroachers who were evicted from the tank bed and the TA. Most of the encroachers were land less SCs. The contention of the leading people of TA is that the rival *saniathanmodu* had made the good use of the cold difference of the people both in VAD and PSP to rise against the TA. Even in the recently held panchayat election, the election promises of those contesting the elections from the faction backed by rival individuals of *saniathanmodu* was that if they are elected to power they would allow the landless to cultivate inside the tank.

The contention of the *saniathamodu*, is that they do not accept the formation of TA, as they feel those who all are represented in the EC are those who would support and do not question the decisions taken by the Office Bearers (OB) which is dominated by persons from *kumalamuttarmodu*.

The TA auctioned fish in the VAD tank for two years after their formation. During the first year, the TA decided that fish would be cultured and sold by them. They appointed guards to safe guard the fishes that were grown in the tank. They harvested the fishes and used a transport to sell it in other villages. During this process, it was only the office bearers who got involved in it and many of EC members did not get involved. As the Office bearers were from the land owning category, the labourer who used to work in their field were utilised to under take physical work in the process of selling the fishes. Owing to the non-compliance of the EC members, the following year, a public auction was called for, during when people from far off places participated in the auction[1]. This time, the collective bidding by few members of the TA won the auction. And after the harvest of the fishes, the accounts were submitted to the TA explaining an incurrence of loses. TA association decided to compensate the loss, by returning the money collected in the auction. This aroused anger amongst many even from the EC of TA against the compensation given. But it was said that the domination of the TA officer bearers silenced the under current that was rising against them.

In both the cases the leading people of the TA blame the rival group for incurring loss. Their contention is that, it was the rival group that encouraged the landless and other to enter the tank and catch fish.

The EC meeting of VAD TA takes place once a month during the evenings of full moon day at the residence of the treasurer of the TA in PSP. During the first year this meeting was held during daytime at the third sluice[2] of the tank. The monthly meeting of the EC is intimated through post to the EC members. This meeting commences by 6 pm and goes upto 9 pm. During which the NGO representative designated as Community

1- The TA made announcement of the auction in local new papers.
2- The third sluice of the VAD tank is also called the middle sluice. All activities pertaining to the tank matter, like fish auction, tree auction and redressal of disputes pertaining to the tank will be held in a space near the third sluice, moreover this place is situated in location that is at the middle of the two hamlet villages of VAD and PSP.

Organiser (CO) responsible for this TA moderates the meeting on the works carried out in the previous month and works that has to be undertaken in the coming month. In order to encourage the EC member to attend this monthly meeting the Office Bearers of the TA had introduced thrift and saving programme, where the members have to save hundred rupees every month, on requirement the saved money will be lent to one individual, who would pay back it with an interest. This change of venue of the meeting and the introduction of the thrift and saving scheme has caused considerable impact on the participation of the EC member like women, SC, and even others in the meeting. Two women members from after the change of venue have not attended the meeting as the timing and the distance did not suit their convenience. Three men members also from VAD do not attend the meeting as they do not have a cycle or a motor bike to reach the meeting venue, they also attribute that the timing also does not suits them. In regard to the introduction of the thrift and saving, few EC members who are unable to part take in it due to their financial problem abstain from attending the meetings. Moreover, this thrift and savings has attracted few other non-EC members who have their interest in it alone. On an average only eleven EC member of the TA participate in the monthly meetings.

Those people who were opposing the formation of the TA for VAD tank, on due course after witnessing the physical work undertaken by the TA in the tank have become eager to associate themselves with the tank association. The explanation given by the OB of TA on the reason for this eagerness is the money that was involved in the works undertaken. There are two issues that arise, the OB of TA complain that the new found interest by those who were antagonistic initially is that they feel that they could make some money out of the works undertaken. The other who wanted to associate themselves feel that the money is not being utilised properly by the OB of the TA. And again here, those who wanted to enter the TA are also the traditional rivals belonging to *saniathanmodu* in PSP. And also there are few from VAD also who wanted to join the TA.

In the EC of the VAD TA, according to the guidelines of the TRPP, people from all categories like the SC, landless, women; and small, large and marginal landholding farmer comprise the 25 members from VAD and PSP. After five years of the VAD TA, the expressions of the SCs, women and few members of the EC do not reflect the cohesiveness of the association. When talking about the TA, they exclude themselves and address the OB as TA. Many of them were co-opted in the TA by the leading people who had their interest in the TA to fill the required number of 25.

The VAD tank water has not been used for irrigation for the past 30 years. There is a substantial number of bores in the command area. The farmers without bore well in the command area are denied the privilege of using the water for irritation when there is water in the tank. In this regard the farmers without bore express their unhappiness. Moreover, their contention is that, if the water is stored in tank to augment the ground water (according to the bore well owners), when there is water in the tank, the price of water that is sold by the bore owners should be reduced, but the fact is that the same price is levied. The other fact is due to the inconsistency of the supply of water in the tank due to frequent failure of rain, the farmers without bore well are dependent on the bore owners. Therefore the upper hand of the bore owners on the decision of the non-usage of the tank water for irrigation remains unchallenged by the farmers without bore in the command area. After the formation of TA, this practice continues, as the OB of TA are also borewell owners in the command area. There is a general acceptance that on irrigating the tank water the yield of the crop would be better than when irrigated with ground water.

CASE II - TANK WATER USERS ASSOCIATION OF THIRUVENNAINALLUR AND SARAVANAPAKKAM

TVN is a big village that has a status of the Town panchayat under administrative classification. According to 2001 census the total population of the TVN is 8582 nearly one fourth (26.46%) are Scheduled Castes.

TVN has a command area of 267 ha for its tank. The tank has three sluices named as *merku vali madugu, kizhaku vali madugu* and *therku vali madugu* i.e. east way sluice, west way sluice and south way sluice. The villagers select by consensus the *Vaikal Maniyam*[1] for the sluices. The *Vaikal Maniyam* had specific responsibilities to be carried out pertaining to the distribution canals from the sluices. In order to manage and maintain the canals one had to use his ability and had to adapt strategies to pool human resources to clean and repair the canals. The resources could be either by contribution through physical work or through cash. The *Vaikal Maniyams* usually are elites, respectable persons who have a command over other farmers in that specific distribution canal. In TVN this post of *Vaikal Maniyam* was hereditary in nature. One of them was from the *Vanniar* caste and two were from the *Udayar* caste

In TVN *Udayar or Tulu Velalar* caste are numerically preponderant followed by V*anniar* or *Gounder* and a substantial number of Muslims. The *Rediyar* caste, though only one family, held most of the land in the village, they are said to be migrants to this village and are not natives. Due to their influence with the then politically influential personalities in the region, it is said by others that they took possession of the *porambokku*[2] lands into their hand and had obtained legal documents for it. Theus assuming power over the other castes in the village. But after the death of the eldest *Rediyar* i.e. after 1962, most of their lands were sold by his sons that was bought by other castes in the village. And their dominance over the other castes also reduced considerably.

The members of the WUA recount that the *vaikal maniyam* is a prestigious position in the village and those in this position had high respect and their words were taken as a command and accomplished with abidance and esteem. The *Rediyar* had a command over the village due to his land holding capacity and his relationship with the officialdom of the state. He controlled all affairs of the village including the irrigation tank, moreover it is said that he would also give directions to the *vailkal maniyam*.

1- *Vaikal Maniyam* literally means canal manager
2- *Porambokku* lands are the lands that are not privately owned

In the year 1976 there was the introduction of *vathu kuthagai* (duck auction) i.e. immediately after the harvest of the paddy in the command area of the tank. It is ssaid that the off spring of the dominant rediyar initiated this vathu kuthagai. the bidder who wins the auction could graze their ducks in the command area after the harvest of the paddy for a period of one year. The amount generated by this *vathu kuthagai* was deposited in the bank under the name of a responsible person , the first was the son of the dominant rediyar, then the village panchayat president and then the president of Farmers Organisation. And the money will be utilized to repair the distribution canals. From then onwards the contribution of the respective command area farmers diminished due to availability of this fund from the *vathu kuthagai*. After this advent of this *vathu kuthagai* there had been incidences where this post was contested under prestige issues between individuals. This has occurred within a caste and also between castes.

Under the Command Area Development scheme, the PWD organized Farmers organization (FO). In which a president of FO was appointed since 1996. This appointment is said to be under political party grounds. This was mentored by the regional representative of the legislative assemble who is called the MLA – Member of the legislative Assembly. The individuals those who were closely associated with the MLA used their influence to become the president of FO, with the consecutive changes in the ruling party of the state and the MLA the leaders of the FO also changed. This president of the FO was later given the responsibility of the *vathu kuthagai* and the maintenance of the distribution canals of the tank. The main reason for the contestation for this position is the authority to manage the *vathu kuthagai* funds. Moreover, the president of the FO also owned lands in the command area of the tank. For the past two years due to a dispute between present WUA president and the then FO president the money remains unutilised.

The tank is said to receive water from the system twice a year according to the irrigation inspector of the Tirukoilur anaicut (barrage) in the Pennaiyar river from were the water is deviated through vents to the canals that takes water to the tank. During January 2007, the water was released through the vents that reached the TVN tank, in addition to the water that was there in the tank due to rains that occurred the previous year. In the command area there is a substantial quantum of bore wells, so the dependency on the tank water by the command area farmers is not eminent. Moreover, the distribution of water from the sluice is not controlled through any sort of allocation strategies amongst them. Individual farmers let out water on requirement through the sluices. During this season, except for one sluice the in other two sluices water is distributed to the command area. The allocation of water is said to be on negotiation between individual farmers on their requirement. The distribution canal of the west-facing sluice that passes through the residential area of TVN remains damaged for nearly a year. The farmers under this canal manage their irrigation through ground water, few of them are not happy, as they are not able to use the tank water for irrigation.

The neighbouring tank to TVN tank is Saravanapakam (SVP) tank. These tanks are contiguous to each other with only a bund dividing the two tanks. The command area of this tank is 126 ha. This tank also has three sluices. The preponderant caste in this village are *Vanniars* or *gounders*, the dominant caste in this village are *Naidu* caste. The command area of SVP tank extends to the neighbouring village of Gokulapuram.

Mudaliar, traditionally weaving community is the only caste that lives in Gokulapuram. Unlike TVN, there were no *vaikal maniyam* for SVP tank.

In SVP, there was a tradition of *pass vari* – which means water distribution tax. Few of the families who had lands in the command area paid this tax. These families had the right over the fish and other resources of the tank. The *vanniars* who constitute the majority in the village have seven divisions or lineage called *Kothu*s. Each *kothu* was headed by a *natamai*. This village institution of *natami* managed the resources of the tank. These persons would take the initiatives to make requests to the PWD officials to release water for their tank. The revenue generated from the resources of the tank was managed by one of *natami* or the panchayat president and was utilized for the general welfare of the village, like organizing feasts during festival times, temple related activities, meeting the needs for the infrastructure in the village. The command area farmers maintain the distribution canal from the sluices by themselves on requirement; the initiatives are taken by the *natamai*s who have the land in the command area.

In SVP, similar to that of TVN politically influential persons holding land in the command area were presidents of the FO.

During March 2004, the elections for the managing committee of the water users association of TVN and SVP tanks were held. In this case, one WUA for the both the tank is said to have designed by the PWD and order were passed to conduct the elections. The command area of both the tanks were divided into four governing division each. And the divisions were numbered from one to eight. Nominations were invited by the PWD for the post of president of the WUA and for the members of the managing committee representing the respective divisions. The main eligibility to file their nomination for any of the posts is one should be a command area farmer holding *patta* (legal documents for the land) in their name. Voter list[1] were made, the eligible voters were the holders of the *patta*.

The elections process had been vigorous in TVN. There was contestation for the post of president and for the members of the managing committee (MC). There were two candidates from TVN contesting for the post of president, both from the same *Udayar* caste and as well from the same political party affiliation. The reason for the contestation was personal differences between the two candidates. Both of them deployed their respective candidates for post of members of the managing committee. The opposing candidates spent money during the election campaign. The candidate who won the president post spent one lakh rupees (2127 US $). He expresses that it would have been a prestige issue if he had been defeated in the election. Of the four members of the MC who won in TVN, one of them hails from the hereditary of the *vaikal maniyam* of west way sluice of the tank, belonging to the *Udayar* caste. Of the four member of MC three are *Udayar* and one from the *Vanniar* caste. The four members of MC and the president are active members of the political parties at the local level[10]. Whereas in SVP four members of the MC were unanimously elected for the respective

1- According the list prepared by the village administrative officer during November 2003, TVN had 629 voters and SVP had 400 voters.

governing divisions of the command area. Three of them are the *natamais* of SVP and the fourth is a politically influential person from Goukulapuram.

The PWD in addition to the conduct of the elections for the president and MC of the WUA, they also formed sub-committee for finance, work, water-management and monitoring. The local officials of the PWD express that under the government orders the WUA and the sub-committees were formed. According to them as there are no funds that are provided for the WUA, it is difficult for the WUA to become active. Moreover, they feel after the conduct of the elections and formation of WUA, there has not been any substantial activities that has happened pertaining to the functioning of the WUA.

In the case of Tank WUA of TVN and SVP, prior to this formation, the respective villagers managed the tanks and its resources. The resources such as grass inside the tank that is used for thatching the roofs of the huts, fishes in the tank, trees inside and in the tank bund. In the first year after the formation of the WUA, the president of the WUA, under his authority auctioned the grass of SVP Tank, the villagers of SVP also auctioned the grass of their tank. This created a conflicting situation between the villagers of the SVP and the president of the WUA who is from TVN. More over the MC members of SVP were in the favour of their villages, as the MC members of SVP are the supporters of the opponent who contested for the post of president and lost. As the result the WUA president lost the race in regard to the grass auction. This year again, the villagers of SVP auctioned themselves the trees in the tank bund and paid an amount to the PWD that was transferred to WUA account. This amount was utilised by the WUA president to pay back the pending amount on the previous years grass auction. The other issue that is concerning the MC members of SVP is the non-compliance of the WUA president regarding the repair of the sluices of SVP tank. When they approach the PWD regarding this, they express that the PWD officials wanted the request to come through the WUA president.

On the other hand, the WUA president is petitioning the district administration, the PWD, the state administration regarding the repair of the canal that distributes water from the west-side sluice of the TVN tank. He also expresses his inability to utilise the *vathu kuthagai* funds for this purpose due to the factional dispute within TVN. Owing to the confrontation of the earlier village panchayat president the *vathu kuthagai* was not held for past five years. The new panchayat president has taken initiatives to hold the *vathu kuthagai*, but ambiguity prevails over the authority and access to utilise the funds generated out of it.

The contention of the farmers of the command area of TVN is that the traditional *vaikal maniyam* were dedicated, their main priority rendered benefits to the villagers; like clearing the distribution canals from the tank for the benefit of the command area farmers, judicial utilisation of resources like fish, grass, fire wood from the trees for the direct benefit of villagers in general. The villagers respected the *vaikal maniyams*; for clearing the distribution canal, all the command farmers would render physical labour when an announcement is made. And in regard to clearing the supply canal, representation will be made from all the households in the village. In SVP, though there were no *vaikal maniyam* but it is said that a similar trend prevailed by the initiatives taken by the *natamais* of the village. But neither the farmers nor the villagers are satisfied with their approaches, as they feel that are not able the see the commitment that was there with the *vaikal maniyams* in the president and the members of the WUA.

TO CONCLUDE..

The state's interventions remain very peripheral that is indeed not enough to shape the processes of the WUAs in the study tanks, as expressed by Mollinga as in the case of AP, which was the pioneering state in regard to PIM implementation in India. Be it the case in AP; the Act that is adopted in TN is similar to that of AP, so from the experience of AP, TN has to make early correction in the process so that the defects that has occurred in AP could be avoided.

The surface water irrigation in the case of study tanks though not considered the important source of irrigation due to availability of ground water; however, there is substantial number of bore wells in the command area. So the WUA and the TA that are formed do not attempt to regulate or control the irrigation aspects (both surface and ground water), rather their interest is more on the other resources that could generate revenue, and thus the competition for positions in the MC and EC in the associations. There is an inherent exemplification of caste, kinship and political party issues that are entangled in all possible combinations under the aegis of the newly introduced irrigation institutions. There are many obvious cases of political indictments exercised by the those in positions in WUA and TA, that affects the

The farmers of the command area themselves take care of the issues regarding water distribution from the tanks. There are spontaneous collective initiatives taken by the farmers who do not have own bore wells, for cleaning the distribution canal from the tank without depending the WUA. The representatives of the WUA of the study tank in TN do not give priority unlike the traditional representation for the canal that existed earlier.

Moreover in the study tanks, the cropping pattern and farming practices are also not in the agenda of the WUA. The reason for this is again the prevalence of independent access to ground water.

With the existing approaches that is witnessed amongst the TA and WUA in the study areas, I envisage that both the TA and WUA would exist, but the would remain only in the state's administrative records. There has to be a revitalisation in the social orientation and mobilisation to be undertaken, to create awareness and the importance of these associations amongst the water users. Reminisces of the Traditional Irrigation institution should be imbibed amongst the water users. Only then these associations would become institutions in the future.

REFERENCE:

1. David Mosse, "Colonial and Contemporary Ideologies of 'Community Management': The case of Tank Irrigation Development in South India", *Modern Asian Studies* 33, 2 (1999), pp.303-338, Cambridge University Press.

2. Dhan Foundation "Agriculture of Pondicherry Union Territory" Report prepared for Madras School of Economics, 2002.

3. Mollinga P.P., Doraisammy R. and Engbersen K., "The Implementation of Participatory Irrigation Management in AP, India", *Int. J. Water*, Vol.1, Nos. 3/4 (2001), pp.360-379.

4. Palanisamy K. and Easter, K.W., *Tank Irrigation in the 21st Century - What Next?* Discovery Publishing House, New Delhi, 2000

5. Ratna Reddy V. and Prudhvikar Reddy, P., "How Participatory is Participatory Irrigation Management (PIM)? A study of Water Users Associations (WUAs) in AP", *Working Paper No. 65*, Centre for Economic and Social Studies, Hyderabad, India, November, 2005.

6. State Planning Commission (SPC), *Annual Plan*, 2005-06 http://www.tn.gov.in/spc/annualplan/ap2005-06/ch_9_11.pdf

PARTICIPATORY IRRIGATION MANAGEMENT OF the MIDDLE SEBOU IRRIGATED SYSTEM

Abderrazak IKAMA[1]

SUMMARY

The large-scale irrigation sector is characterized by the State's direct intervention while small – and medium- scale irrigation is run locally by traditional associations in so far as management and operations of the district are concerned.

The year 1969 saw the promulgation of the Agricultural Investment Code, which was the first legal instrument of its kind to govern management and operations of irrigation schemes and which requires that users basically contribute to the State's financial effort without actually involving them in the implementation of irrigation development projects.

This approach based upon the State's unilateral intervention inevitably resulted in adverse effects (deterioration of equipment and frequent recourse to rehabilitation operations). Faced with this critical situation, the government opted for the development of Participatory Irrigation Management (PIM) as early as 1990.

The adoption of PIM as an irrigation policy was a strategic alternative aiming at revisiting a methodology previously used in the beginning of the 60's--a period when each irrigation development was unilaterally designed, funded and implemented by the State rather than through a participatory approach involving consultation with, organization and commitment of water users.

The Middle Sebou irrigation scheme, located in the Fez area, provides a highly representative illustration of the transition from centralized management to consultative management. Indeed, the development of this 6500- hectare area was carried out through a new development and irrigation management pattern stemming from a partnership holding between the State and water users. This approach is aimed at sharing roles and responsibilities and effectively getting users grouped in Water Users' Associations (WUAs) supervise management of their irrigation systems.

Therefore, the Middle Sebou irrigated system is run through a contractual framework directly by the beneficiaries who are adherents to any of the twelve Water Users' Associations (WUAs) which are structured into two federations.

1- Rural Engineer, Head of the management unit of Sahla project, rural engineering department, Morocco

I. AN OVERVIEW OF IRRIGATION IN MOROCCO

I.1 BACKGROUND INTRODUCTION

Morocco's climate fluctuates between semi-arid and arid conditions and is typified by a rainfall that varies from one region to another and has increasingly unsteady annual and seasonal patterns, which make irrigation an incontrovertible imperative to boost agricultural production and to enhance farmers' income.

Morocco's irrigated sector is divided into two sub-sectors:

- Large-scale irrigation systems with water supplies from big dams and with considerably sizeable areas recently equipped with modern networks. The irrigable potential area through large-scale hydraulic structures is estimated to amount to 850, 000 hectares.
- Small- and medium-scale irrigation, where the systems are small-sized and are, to a large extent, irrigated using local water resources. The irrigable potential of small- and medium-scale irrigation is estimated to stand at 785, 000 hectares.

I.2. BASIC OPERATING STRUCTURE OF IRRIGATION INFRASTRUCTURE.

Large-scale irrigation infrastructure is characterized by the State's direct intervention through its being a developer, operator and caretaker of the operations of irrigation systems with a view to ensuring their durability. This is not the case of small- and medium-scale irrigation, requiring ongoing consultation with the local population who are already clustered in traditional associations to supervise management, operation and maintenance or even renewal of irrigation infrastructure.

In 1969, within the framework of the Agricultural Investment Code which stipulates that water users must, for their own benefit, contribute towards the State's financial effort, amongst the body of statutory and regulatory provisions adopted then, two of them pertain directly to the management of large-scale irrigation systems.

- A direct contribution, estimated at 30% of the expenditure incurred by development costs calculated on the basis of equipped acreage.
- The payment of an annual water fee was intended to recover 10% of the investment, development amortization costs as well as for all expenditures incurred by operations and maintenance of the irrigation infrastructure. This annual fee per cubic meter of used water was calculated on the basis of an equilibrium price set periodically through a joint decree by the Ministry of Agriculture, the Ministry of Finance and the Ministry of Equipment.

Such a unilateral intervention by the State inevitably led to adverse effects; namely, the increasing importance of the actions the State had to carry out in order to ensure better functioning of irrigation infrastructure on the one hand and the serious lack of interest of water users towards infrastructure, often subjected to recurrent and costlier degradation.

The responsibility of government in such situations was to opt for Participatory Irrigation Management (PIM) as early as 1990.

The adoption of PIM was, therefore, a strategic alternative put in ballast by the State. This strategic alternative allowed revisiting the irrigation policies formerly used in the beginning of the 60's and making of irrigation development a sector which was exclusively designed, funded and implemented by the State.

- PIM as a participatory approach involving consultation, organization and commitment of water users within a contractual framework was a constitutionally-based response to management of irrigation systems. PIM would enable:
- To effectively involve users in, and increase their responsibility for irrigation water, development, operations and maintenance of equipment and irrigation infrastructure;
- To promote dialogue and implementation of concerted actions between the State's watershed agencies and farmers in irrigated systems;
- To create good management practices for water resources, equipment and irrigation infrastructure;
- To achieve rational use of both water, soil, equipment and irrigation infrastructure to serve not only the interests of irrigated agriculture, but the interests of the nation as well;
- To increase the returns of water and allocate it efficiently.

II. DESCRIPTION OF THE MIDDLE SEBOU AND DOWNSTREAM INAOUEN IRRIGATION SYSTEM

II.1. PROJET AREA

The Middle Sebou and Downstream Inaouen irrigation system covers 15,000 hectares acreage and is located at the piedmont of the Rif mountains, 60 kilometers away from Fez. From an administrative standpoint, this system falls within the jurisdiction of the Fez Wilaya and of the Provinces of Taounate and Sidi Kacem.

This system was split into five main district irrigations for purely economic and technical considerations and development of irrigation infrastructure was carried out in two stages:

- The first phase includes district irrigations I and II extending over an acreage of 6,500 hectares. Development of the irrigation infrastructure was launched in 1994 and completed in 1998. District irrigation II (3,500 hectares) got irrigation water in 1998 and district irrigation III (3000 ha) got it gradually during the 2001/2002 crop year.
- The second phase encompasses irrigation district irrigations I, IV and V covering an acreage of 8,500 hectares. The preliminary study and implementation procedures are being carried out. Effective operation of these irrigation district irrigations is slated for 2007.

Water supply is ensured through pumping stations, strewn all along the banks of the Sebou river whose waters are regulated by Idriss 1st dam—Matmata- with a yearly throughput capacity of 1.2 m^3. Irrigation water allocated to the system amounts to 130 m^3 yearly.

II.2. PROJECT COMPONENTS

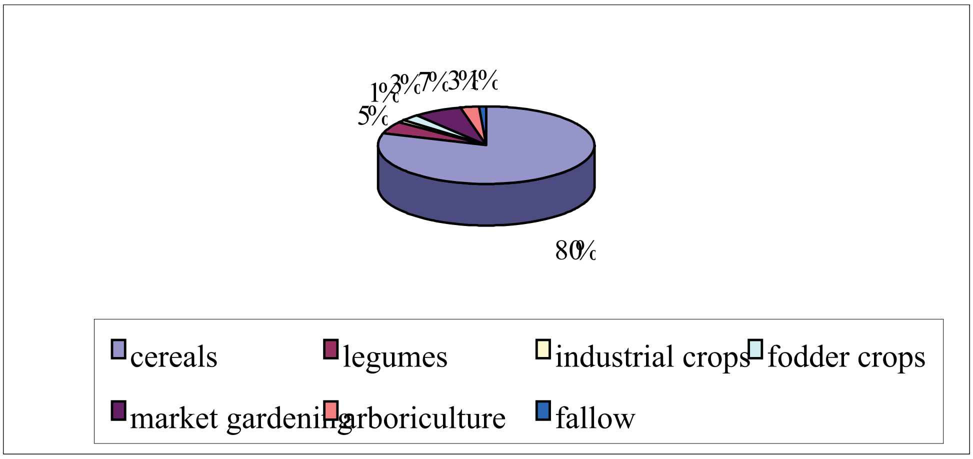
II.2.1 Hydro-agricultural development

The main hydro-agricultural development activities focused on external and internal developments; namely,

- Construction and fitting of 42 pumping stations (main and booster stations)
- Supply, transport and laying of irrigation canals and pipes;
- Construction of a 90 km power distribution line;
- Steering a cadastre operation (land clearing, deep ploughing, land leveling) over 15,000 hectares;
- Building internal and external drainage networks;
- Construction of a road network.

II.2.2. Agricultural Development

The initially applied cropping system is highly favorable to cereals, grown by almost 98% of farmers and represents 81% of crop rotation, along with a quasi absence of fodder breaks. Plant and animal productions were low.



A quadrennial crop rotation scheme was chosen for this irrigation scheme - with an average intensification of 150%. As far as agricultural development is concerned the following main orientations were targeted:

- Introducing new ‘value- added’ cash crops such as sugar beet, tobacco - market gardening crops. Aromatic and medicinal plants will probably be cropped as farms are generally small-sized;
- Increasing production of fodder crops since dairy production is high on the agenda;
- Increasing cereal and fruit tree production through applying appropriately-sound techniques;

II.3. AIMS OF THE PROJECT

The main aims of the project are as follows:

- Improving and intensifying crop production (market gardening, sugar beet, fruit trees) and animal production (milk, meat);
- Increasing farmers’ incomes (from €130 /hectare as a per annum net take-away profit margin prior to the project to around €1,200 / hectare after the project);
- Improving standards of living within the project area through electrification and road infrastructure development;
- Increasing job opportunities (from 25 work days/ per inhabitant /per annum prior to the project to 150 work days/ per inhabitant /per annum after project implementation;
- Creating and enhancing capacity-building of associative movement with a view to enabling water users to undertake tasks relating to management, operation and maintenance of irrigation infrastructure.

II.4. COST – PROFITABILITY AND FUNDING SOURCES

The project cost amounts to 133 million Euros. Economic profitability rate was initially estimated to stand at 11.7% in June 1994.

The cost of the preliminary irrigation batch, estimated to be 54 million Euros, is financed up to 50% by the French Development Agency. The remainder is funded by the Moroccan budget.

III. IRRIGATION MANAGEMENT SYSTEM

The new strategy for irrigation development and management is based upon a partnership scheme involving the State and water users. The purported aim is to share roles and responsibilities and to effectively involve water users, who are members of Water Users Associations (WUAs), in the management of irrigation systems.

III.1. INSTITUTIONAL ORGANIZATION

a) Approach:

The approach adopted for establishing irrigation associations in the perimeter draws upon communication between all stakeholders involved in the project.

In short, this approach draws upon lending an ear to the stakeholders, promoting mutual understanding and taking account of (i) attitudes and knowledge of all concerned parties, particularly those who are influential in communities and local groups and (ii) emergence of new leadership with innovative projects.

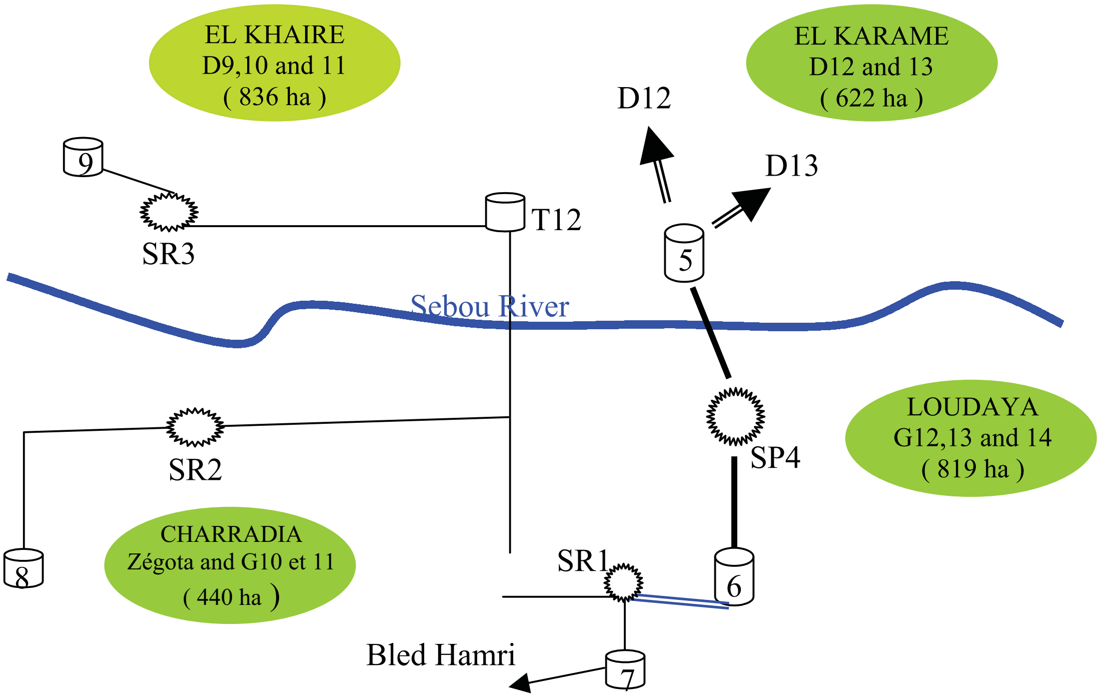
The establishment of Water Users Associations (WUAs) was the fruit of consultations and negotiations involving various partners. Meetings were marked by a transparent dialogue and by the concern to promote connivance and togetherness to avoid misunderstandings.

A program of awareness-building meetings was then drawn up in joint collaboration with various representatives of the local population and opinion leaders. Subsequent to this thorough groundwork, the scope of activities was widened to include all concerned parties. This contributed to accurately defining the boundaries of each WUA.

b) Institutional Framework

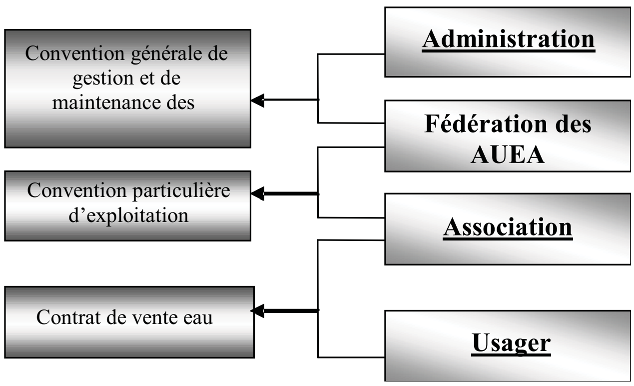
The organizational framework pattern was endorsed subsequent to a series of consultations held with water users. It provided for shouldering the WUAs with tasks relating to (i) technical and financial management of all irrigation infrastructure and pumping units (ii) operation and maintenance of water distribution and drainage networks.

Synoptic Diagram of District Irrigation II Infrastructures



c) Contractualization of relations between the various players

Within a contractualization framework, the WUAs clustered within a federation are entrusted with the responsibility of carrying out operation and maintenance of water infrastructures by the State. Relations between the various partners are governed by:



- The agreement between the administration/federation-WUA together with a general specifications book, which lists down the irrigation infrastructure and equipment put at the disposal of the associations and their federations, the water allocation for each sector, the technical, financial and organizational provisions, thecontrol mechanisms of commitments made as well as the human and logistics support of the administration and its length in time.
- The Federations/ WUAs agreement which defines the responsibilities and obligations of each organization with regard to management, operation
- and maintenance of irrigation infrastructure as well as intervention levels in connection with invoicing and recovery of irrigation water fee.

- Standard procedures of Federations and WUAs which set subscription fees, invoicing and irrigation water fee collection procedures, internal financial and administrative management procedures, as well as the disciplinary provisions related to water service management.
- The water sale contract (User/WUA-Federation) which defines water allocations, distribution modalities, invoicing and irrigation water fee collection procedures.

III.2. IRRIGATION MANAGEMENT

Two management levels have been the focus in each of the two irrigation-based developed districts:

- The upstream level which corresponds to the main water infrastructures shared by WUAs : i.e. pumping and booster stations, pipes, transfer canals , balancing reservoirs, drainage, the external protection system and the roads easing access to the irrigation infrastructure. The federation shoulders the responsibility of managing all these components.
- The downstream distribution level encompasses the whole infrastructure of all irrigation networks, including drainage and earth roads leading to plots allocated to each association in the irrigated system. The infrastructure also incorporates supply canals, water intakes and main pipes operated and maintained by each WUA.

a) Operation and Maintenance of Irrigation Infrastructure

All activities related to operation and maintenance of hydro-agricultural equipment shall be entrusted to WUAs and their federations. WUAs and their federations have recruited their own staff; namely,

- Watermen who ensure appropriate irrigation water distribution, operation and maintenance of irrigation networks and enforcement of water policing;
- Pumping station operators who ensure proper operation, preventive care and maintenance of pumping stations;

The administration has made available to the federation a qualified technical team of engineers, technicians and a management accountant, to serve on a temporary basis and for a limited period of five years so that they could help it to carry out its missions successfully.

b) Pricing of Irrigation Water

The pricing of irrigation water is adopted based upon applying the principle of real water price. Indeed, the water fee covers all the costs associated with water service; namely, energy, operation costs, maintenance of equipment and repairs.

Each water user must pay:

- a mandatory annual WUA proportionate to the cropped acreage s/he owns within the perimeter;
- a three-month water fee which is proportionate to the amount of water used in compliance with the individual contract signed with the WUA and the federation.

These water fees are set in such a way as to allow for accounts equilibrium and observance of the commitments made by the WUAs and their federations.

IV. ACCOMMODATING MEASURES AND FUTURE PROSPECTS

IV.1. ACCOMMODATING MEASURES OF THE IMPLEMENTED OF THE PIM

If Contractualization of relations between the State and organized farmers provides for a five-year transition period, no strategy has as yet been devised to equip the associations with the required training to ease take over of tasks subsequent to the withdrawal of the technical staff afforded to them by the administration despite their being daily supervised by this very technical staff. It is deemed necessary to design a concerted action program targeting the members of the governing board of WUAs, their federations, the watermen and pumping station operators.

This program should be tailor-made to enable the various partners (WUAs and their federations) to undergo an efficient and effective training--- a training that will enable them to successfully take over management, operation and maintenance of the irrigation systems.

The implementation of this program must necessarily identify the tasks each partner should carry out. With these tasks in view, the training program must be, therefore, adjusted in such a way as to appropriately empower the various partners for tasks incumbent upon them.

Strengthening Participatory Irrigation Management requires the following support means and measures:

- Training and readying supervision agents for new relations with WUAs;
- Training board members of WUAs to gain deeper insights into their missions and statutory

functions;

- Training WUAs' technicians (watermen) and those of the federations (pumping station operators) in techniques for operation and management of hydro-agricultural works.
- Emancipating water-user members of these WUAs so that they become real partners of the administration.

IV.2. FUTURE PROSPECTS

Success of this new strategy for the enhancement of Participatory Irrigation Management is contingent upon:

- Reforming the legal texts;
- According to the 1969 Agricultural Investment Code, irrigation infrastructure belongs to the State, which in itself is a hindrance to the work of the federation to collect funds for renewal, repair and rehabilitation of water structures which fall within the prerogatives of the State in its capacity as the exclusive owner of the irrigation infrastructure.
- Effective involvement of all stakeholders with regard to pre-feasibility study on irrigation development schemes (choice of area, type of irrigation pattern);
- Opening up an act on voting rights in such a way as to enable all members to be elected taking account of their farm size. In so doing, the board of WUAs will not be monopolized by a particular group of farmers only.
- Disseminating enforcement circulars in order to reinforce or clarify the directives of legal texts, such as exemptions on VAT.
- Promoting sound financial management in connection with opportunities of investment of funds available to WUAs and federations so that they can make their capital yield a fruit and thus increase their income.
- Carrying out irrigation development projects through an integrated framework. Indeed via Participatory Irrigation Management, the institutional and organizational aspects are under better control. Still, a lot remains to be done with regard to increasing the returns of the cubic meter of water. This can only be done through engaging in a partnership scheme involving all concerned parties particularly farmers, administrators and manufacturers.
- Taking account in project design of the environmental component by anticipating and assessing the potential impacts on the ecosystem.

PARTICIPATION OF FARMERS IN THE MANAGEMENT OF RAINAGE SYSTEM

Mumtaz Ahmed Sohag[1], Ali Asghar Mahessar[2], Masroor Nabi Memon[3]

To combat waterlogging and salinity, initially a number of Salinity Control and Reclamation Projects (SCARPs) were introduced 1960s in Pakistan. And also, surface and subsurface drainage system and biological drain system has been introduced for controlling over twin problem of waterlogging and salinity in the country level. Out of total irrigated area of 16.69 Mha (41.23 Ma), 7.545 Mha (about 45%) has been covered under drainage. Still 9.14 Mha (22.59 Mha) needs to be provided drainage facilities in the irrigation basin system of Pakistan.

Institutional Reforms has been introduced within water sector by act 1997, in the Sindh Province Pakistan. Through these reforms Sindh Irrigation & Drainage Authority (SIDA), Area water Boards (AWBs) and Farmers Organizations (FOs) were formed at barrage, main canal and distributaries/ minor levels. Drainage Beneficiary Groups (DBGs) have been made on branch drainage system levels. These reforms have provided good opportunity to the farmers/stakeholders participations in management of Irrigation as well as Drainage system in Sindh province of Pakistan.

The Left Bank Outfall Drain (LBOD) which consisted on Spinal drain and Link drain such as the DPOD, KPOD and Tidal Link has been constructed in recently which will receive drain water from left side of Indus River for disposing off into Arabian Sea While Right Bank Outfall Drain (RBOD) is under construction on right side of Indus River which will receive water from Upper Sindh and Balochistan for outfalling in the creek of Arabian Sea. The drainage system/ network in the commanded area of Kotri barrage has been introduced in 1960s. This system covers both sides of Indus Rivers and downstream of Kotri barrage which is under jurisdiction of Districts Thatta, Tando Muhammad Khan and Badin on right and left flanks respectively.

There are many constraints/problems for safe removal of drains water, such as, high tide low hydraulic gradient, mismanagement of operation and maintenance of the system, defer of maintenance, not proper collection of revenue and drainage cess, lack of interest of framers/stakeholders towards drainage system, heavy rainfall and cyclone frequently, low crop yield, high value of input, low value of output, shortage of irrigation supply, impact of waterlogging & salinity, fertility of soil, effluent of Sugar mills, polluted of surface canal waters, highly saline groundwater, deteriorating conditions of communication infrastructures, poor living standards, bad environmental

1- General Manager (R&D), SIDA, Hyderabad, Pakistan
2- Deputy Director (Water Resources), EMU-SIDA, Hyderabad
3- Junior Engineer, SIDA, Hyderabad

impacts over ecosystem, frequently earth due to unstable slopes in silty stretches; these all constraints/problems are brought under discussion during meeting with farmers/stakeholders to address for better management of drainage system in the study area.

INTRODUCTION:

Pakistan is a developing country having highest population growth rate of about 3% per annum that requiring the increasing water demand year by year. The demand of water consumption can be coped with modernization of irrigation system through Integrated Resources Management and better management of drainage network and support agricultural modernization for the sustainable development, socially, environmentally and economically.

Pakistan is bestowed with the largest integrated irrigation network in the world. This makes Pakistan essentially an agricultural-based country and therefore, its economy largely depends on the irrigation system. Surveys carried out from time to time indicate that conveyance losses range from 20% to 30%. The colossal wastage of water, not only decreases water for agricultural, industrial and domestic uses but also creates the problem of waterlogging and salinity.

Unlike the integrated irrigation network, Pakistan's drainage network is not interconnected. Much of the drainage effluent is either reused in the Indus basin Irrigation System (IBIS) or disposed into the rivers and canals. The needs to be constructed drainage basin in each canal command area for avoiding environmental degradation through interconnecting the drainage system of the country in order to dispose off all effluent water drainage into the Arabian Sea.

There are several principal causes of water logging and salinity, namely irrigation without drainage, over irrigation, low delivery efficiency of the irrigation (35 to 40 percent from canal head to root zone) and inadequate drainage system., Low hydraulic gradient of Sindh Province, obstructions and obstacles developed in natural depressions through construction of railway lines, lanes and roads. The semi-arid climatic conditions prevailing in Pakistan also lead to accumulation of salts in the root zone. In addition, irrigation supplies add salts every year to the root zone. Groundwater pumpage, which is unregulated, further aggravates the situation by mobilizing salts dissolved in the groundwater aquifer

The drainage of Sindh Province covered 2.724 Mha (6.732 Ma) where drainage facilities have been provided through 4190 tubewells in Fresh Ground Water (FGW), 2256 Saline Ground Water (SGW) areas including 361 scavenger wells, 9185 km surface drains and 4046 km of sub drains (Tile drains). The project are; LBOD (Stage-I) constructed to carry the saline effluent from the left bank area of River Indus through a system of spinal drains, main drains and Tidal Link to the Arabian Sea and RBOD (Stage-I), which is under construction and will provide drainage facilities for the Indus Right bank. About twenty four percent of the area is severely waterlogged and out of which 54% is saline and needs to be covered under drainage.

MAIN OBJECTIVES:

The main objective of this study is to review & examine the functioning of the drainage system and environmental an socio-economic impacts and also agricultural enhancement in Kotri Drainage circle. Therefore a study exploratory survey has been conducted on the selected systems due to the short span of time.

ii. To address the problems in surface drainage system.
iii. To examine performance of the drainage network..
iv. To assess potential for the re-use of drainage effluent..
v. To examine Operation &Maintenance of the system.
vi. To diagnose the causes of the drainage problems/ threats with a special view to prevent water logging & salinity.,
vii. To assess socio-economic conditions of local people
viii. To assess environmental impact in the study area

STUDY AREA

The area of the drainage circle commonly is located in deltaic areas low-elevation above MSL flat but slightly sloping from the apex to the sea, land underlain at shallow depth by un-ripened soils & marine saline ground water drainage outfall to the sea constrained by the tidal regimes, at the sea side the cultivated land of the command transits into extension flat type of coasted fore lands, flooding by the sea is only the incidental problems and there are no distinct coastal embankments. Natural drainage conditions vary with the higher lying lands in the upper command.

MEETINGS FARMERS/STAKEHOLDERS

The meeting were held with Farmers Organizations (FOs), namely Pandhi Wah, Shah Bukhari minor, Dandhi Mubark wah, Jarki minor, Pthan hassan Ali minor, Dodo minor and etc and also the field visits have been conducted and the data about studies have been collected. Poor performance of drainage system Loss of lives and damages due to flooding caused by cyclone, heavy rain fall, capacity of drainage system, breaches of embankments, Water logging and salinity problem, Backwater flow of certain main and branch drains, the high tidal effects, severe pollution of irrigation and drainage water, Over-use of irrigation water in the upstream area and severe shortage in tail-end areas, certain loss of fisheries recourses in Dhandh and reused of drains water.

IDENTIFICATION OF PROBLEMS AND CONSTRAINTS

In this regard, physical status of drainage infrastructure has been visited and examined, as well as the meetings were held with local people of different walk of life and interviews were conducted & recorded in order to identify the problems related to irrigation system, drainage network, socio-economic & environmental issues. This collected information and data has provided much more views to address the problems and the issues, described as under.

DRAINAGE NETWORK

The construction of the Kotri barrage which happens cause over application of irrigation water for higher crop intensity within its command area. Therefore, it was realized for prerequisite of Drainage System in the command area of barrage. There are about 8.0 million cusecs per day canal water is being delivered for irrigation of 2.0 million acres of agriculture land. The application of increased quantity of water and cutting of natural drainage lines by network of irrigation canals, railway lines and roads have resulted in waterlogging and salinity in the canal command area. In 1959, the waterlogging problem became very acute in certain areas that it became necessary to undertake a drainage scheme in the Kotri Command area.

DRAINAGE CESS

During the meetings, farmers apprised to that the surface drainage network suffers from weed growth and banks sloughing, as well as degradation of structures and insufficiency of outfall. The major cost of the improper maintenance and operation of the system are the shortfall in revenue generation i.e. Abiana and drainage–cess as well as paucity of development funds for the modernization of the system. In order to understand these complicated problems of system and improve the operational efficiency of Kotri Surface Drainage System. The stakeholders brought under discussion both the physical status and improvement needs of the system as well as O&M requirements, given the present and future Scio-Economic, and environmental requirement of the catchments area of the drainage system.

The drainage system is facing problem of operation and maintenance since its construction. This system is directly not source of earning for farmers and other stakeholders but indirectly provides good opportunity for sustaining of land fertility and safe disposal of heavy rain water and pancho water. Owing to deferred maintenance of drains which provides space to thorny bushes and reeds to develop in the prism of drain. Therefore, recently Government has taken initiative steps for levying cess for revenue collection as proper operation and maintenance can be carried out.

HEAVY RAINFALL AND CYCLONE

The average annual rainfall in the study area varies from 6 inches to 9 inches. Most of it occurs in the months of (July and September) monsoon season. The hottest months are May and June and coldest is January. Light rain showers occur occasionally in January & February. Although the annual rainfall is low, yet the project area is subject to severe storms. This area receives the heavy rainfall and the cyclone within frequency of four or five year. In 1992, 1994, 1999 and 2003 there was heavy rainfall and the drain which was already silted up could not accommodate the storm water. This caused heavy losses to standing crops and property and damage to drain sections. The prism sections of the drains have almost been lost due to flow well beyond their capacities.

SEA INTRUSION

Farmer told that the drainage system is under close to coastal area, therefore, drainage effluent is being disposed off into Arabian Sea. The Surface drainage system of Sindh province has been diverted for out-falling directly into the Arabian Sea via tidal creeks.. The tides cause reverse flow in the systems especially during high tides. Land slope along the lower reaches of the open drain are practically flat and ground water tables are high with heavy salt contents. Hence these areas are badly flooded especially during the monsoon season. This problem is more aggravated due to deferred maintenance of the drainage system.

There is large Kotri Drainage Circle network so that there was not possible to conduct study of over all Drainage Circle. Keeping in view, six (6) main drainage system have been selected out of eighteen (18) of Kotri Drainage circle. There are following selected six drainage system whereof study was carried out with participations.

I. Ghora Bari Outfall Drainage System

II. Jamsakro Outfall Drainage System.

III. Nagan Dhoro Outfall Drainage System

IV. Karo Ghungro Outfall Drainage System

V. Fuleli Guni Outfall Drainage System.

VI. Lowari Branch Drains System

THE SELECTED OUTFALL DRAINAGE SYSTEMS:

Surface Drainage Systems above mentioned which are located in Badin and Thatta district of coastal area of Sindh Province of Pakistan. The drainage system was constructed in 1960s. The area lies in the Canal Command area of the Kotri Barrage. The drains water of the system outfalls into different creeks of Arabian Sea by gated and ungated structures. The network presently comprises a main outfall drain, branch drains and field drains and also catchment area of drain. Due to improper operation and maintenance, the drains have been silted up badly, resulting growth of weeds and reeds. banks sloughing has also occurred.

The drainage system has been damaged due to not proper maintenance and repair of infrastructure. Therefore, embankments of main drain and branch drains are in poor condition. The breaches and erosion have been developed in the drainage berms and flanks of banks due heavy rain. The weeds and reeds have been grown in the prisms of the main drain and sub surface drain system which cause of obstacle of smoothly flow and take place shape of afflux.

Outlet structure, Left bank outfall wing has partially collapsed, which affects main outfall structure and starts to endanger asphalt road. Depending on drainage water discharge, saline water enters more or less far from the tidal creek into the lower reach drains, thus negatively affecting neighboring lands, groundwater and crops was observed.

The study of this system is required to investigate the feasibility of structures and including drainage system, which integrates i.e. hydrologic, hydraulic/flood protection, tidal, agricultural, irrigation and drainage water quantity and quality management, environmental and O&M costs aspects. This study may serve as a pilot for similar situations (but on a larger scale) of low-laying lands crossed by major open outfall drains discharging into dhands in the tidal fringes of the Left Bank of the Indus.

ENVIRONMENTAL & SOCIAL IMPACT

Kotri circle of drainage system is considered in the coastal region, This region has been come under impact of heavy rainfall and cyclone frequently average between 4 and 6year. The cyclones and heavy rainfall have destroyed the ecosystem and soicio-economic standards of the local people. Therefore, this region has to face environmental physical, biological, socio-economic issues frequently. The network of drainage system of Korti circle has brought some extent good opportunity for improving negative environmental impacts but due to construction of this network created obstacles in the natural ways of run off rainwater or inundated flow on one hand, while lack of operation and maintenance of system happened more cause of environmental adverse impacts in its jurisdiction.

The jurisdiction of Kotri Drainage circles comes under canal command of Kotri barrage. In this area water is being supplied through perennial and non-perennial canals. Therefore, during dry season local people and livestock consume drainage water for domestic and livestock. On the one canal water is being polluted by wastewater municipal and industrial and also effluent water of established of sugar mills in the command area of Kotri Barrage which also have been dumping their effluent into the drainage system on the other hand. It is really fact that the local people and ecosystem is only source of consuming canal water and drainage water because ground water is heavily saline. The recently, they could not receive potable water for drinking purpose and other purpose. The application of such type polluted water will not cause of demise fertile lands, animals and ecosystem but also of humans gradually.

Environmental issues were also discussed with the stakeholders, and outlined no significant negative environmental impact; however the stakeholder complaint about the effluent of sugar mills and stagnant water due to which smell and other environmental issue occurs.

In view point of the stakeholders and from our team view point the following suggestions are made; Sugar mills owners in the area may be asked for the in house treatment of the their mills effluent before discharging it into drain, domestic sewage of the towns and cities should be treated before discharging into near by drain. A monitoring plan is proposed and implemented under O&M component Stagnant water may be drainaged by making natural flow arrangements.

The data regarding the social and economic aspect were collected on the questionnaires by questioning the different categories of the stakeholders i.e Landlords, Farmers, Fishermen, NOGs, Agricultural Departments Labourers, and Servicemen etc.General Socio – Economic query is consisted on the following points, yearly income by all sources, expenditure during the year, technical persons as an additional source of income, health care facilities including the maternity facilities, Social problem faced by then and any assistance from government organization, environmental aspects affecting their living and agriculture productivity, Source of domestic use of water, Irrigation water and its distribution, Merits and demerits of drainage networks, usage of drainage water for domestic use and agriculture purpose, Participations in the drainage system

RESULT AND DISCUSSION

During the meetings were held and field visits have been carried out for better management of drainage system through participation of farmers/stakeholders. The farmers are real stakeholders of operating and maintenance of irrigation and drainage system. During discussion it was realized that farmers were more interest in the management of irrigation system than management of drainage system. It was observed that farmers/stakeholders were not familiar with the importance of drainage management.

During the meeting with farmers/stakeholders, NGOs, FOs, about management of drainage system following aspects was covered during study such as:

- Drainage / Canal systems performance
- Socio-Economic Conditions
- Environmental aspects

Keeping all objectives of study in view, the following points and facts have been observed and documented:

- Non awareness regarding the drainage system of the stakeholders were noted.
- Mostly the stakeholders were interested in the canal system rather than Drainage system.
- Natural drainage conditions vary with the higher lying lands in the upper command, being some what better drained than the lower lying lands in the lower commanded and in depressions.
- Drainage condition in the lower command area and in the depression adversely affected by the discharge and collection of excess surface water in the area.
- Water logging and salinity problems were visible in the catchment area.
- Though the record regarding alignments dimensions and design criteria are available of the irrigation and drainage system in the concerned office, but at the site there was found much variation in design parameter of the systems.
- Drainage systems have not been designed for multifunction use (e.g. cattle drainage, re-use) and also according to heavy rainfall.
- No plan was made regarding the development of the drainage system for consultation with local Community.

- Blockage and obstacle in certain main, branch and sub drains were observed due to closure of drains by the local people for their crossing purpose or otherwise due to reeds, weed and sloughing of site slopes.
- The drain sections at some places have widened whereas the infrastructure are al most the poor condition, hence the cost of maintenance of drain prism may increase.
- The outfall structures available were not functioning properly.
- Where there were no outfall structures at the outfall points, therefore, sea intrusion has damaged the drainage network up to about 10 Km in upstream.
- Farmers and other stakeholders showed less interest to own this system for operation and maintenance because they are considering this huge network so that it not possible for them to manage and operate on one hand while they have been referencing about low crop yield due to salinity and waterlogging and frequently impact of cyclones. Therefore, there is need of establishing Drainage Beneficiary Group (DBG) and conveying positive benefits from this system.
- The drainage water has been used for crop without considering negative impact over fertile lands.
- Dhands are located in the coastal area which have been supplied pancho water from irrigation system so that they have been maintaining their sanctity but due construction of Drainage system and huge network LBOD system have put serious impact on this dhands. Therefore, these have been converted from fresh water saline.

SUGGESTION / RECOMMENDATION:

The Researcher observed number of adverse issues in the study area, on the basis some suggestions and recommendations are given below:

- There is stern need of creating awareness among farmers/stallholders about importance and self operation and maintenance of drainage system.
- There should be given top priority for establishing Drainage beneficiary Group (DBG) for operation, maintaining and self sustaining of drainage system.
- The capacity of drainage system in the Kotri Drainage circle should be enhanced according to heavy rainwater, as rain water can be safely dispose off into creeks of Arabian Sea.
- Awareness should be created among Farmers and stakeholders for not making breaches and cuts in the drainage system during heavy rainfall.
- The gated structure should be constructed at all outfalling points for averting sea intrusion and controlling high tides of sea, otherwise, sea intrusion may cause degrading fertile lands, negative environmental and socio-economic impact.

- There is hard need to construction small ponds at upstream of each outfall structure, as drainage water may be store in the ponds during high tides.
- During field visit it was observed that drainage water is being utilized for cropping through lift machine without knowing quality of water. Therefore, this water has put negative impact over fertile lands.
- There is very important to monitoring water quality of drainage system after that can be applied for cultivating of crops. Otherwise, the saline water may cause of devastation of fertile lands and which leads low crop yield.
- The Protective Embank may be constructed along with coastal area for controlling sea intrusion, flooding during cyclone. This bank will provide facilities to local people to save their lives and their livestock through shifting on it.
- It is clear fact that due to defer of maintenance of drainage system which has badly affected on the operation, Therefore, Government should pay serious consideration for improving this system with the consultations of local people and stakeholders.
- It is important to mention that out these lagoons some are in RAMSAR commission. Accordingly, ecosystem of the lagoons has in dangerous conditions and also cause of deteriorating socio-economic conditions of local people and fishermen.
- The subsidiary should be paid to the farmers in seeds and fertilizers as they can improve crop yields.
- The irrigation system supply may be made perennial basis that may increase crop productivity. This is tail area of irrigation system of our country so it has always been facing shortage of water.
- The groundwater is saline that can not be used for application of land for cultivation of crop and for utilization of domestic purpose so that entirely ecosystem in the command are of Kotri barrage depends upon the fresh surface water of canal.
- During conducting interviews from local people in the catchment area that they have been crying about not only shortage of water but told that they have receiving polluted water from canal system and drainage system for drinking purpose. They told that urban and industrial effluent was disposed off into both side of canals of Indus River. Therefore, it should be not dumped into canals as they can save waterborne diseases.
- Social and economical conditions of local people was poor due lack of awareness, low crop yield, low literacy rate, victimization of heavy rain fall and cyclone frequently.
- The house building structure of local people was constructed of raw material and that constantly remains in danger due to heavy rainfall and cyclone.

- The life standards of the local people was realized poor due to lack of facilities of communication system and education system.
- Ideas / opinion of stakeholders regarding the benefits of the drainage system and their interesting coordinator and responsibility to take own the O&M of the system of on farm drainage system.
- To developed and improve the use of both natural as well as human re-source are environmental sustainable economically feasible and socially equitable way, through improved drainage and related water management in the individual drainage problem.
- Identification objectives i.e. protection of Irrigation and drainage water quality against pollution, reduction of the saline surface effluent quality through technical measurement, protection against storm water management to prevent solution for drainage problems and disposal of drainage water with the random of selected system, to have sufficient social support for the implementation of the system effectively.
- The need of organizational development which can enhance capacity with several factors in the new approach to drainage development. Multifunctional designs for structures, which have several purposes to be improved as people are not familiar with multifunctional of operation & Maintenance drainage system.

REFERENCE:

1. Report on Drainage Master Plan of Pakistan, December, 2005.
2. Mahessar A.A, Improving Irrigation Water Management through Participation of Farmers Organization at Potho minor.
3. Stakeholders Consultative workshop on Environmental monitoring Plan of Left Bank Outfall Drain (LEMMP- BOD), November, 2004.
4. Soomaro, Muhammad Saleh, Management of Effluent and Remedial Plan for LBOD System. November, 2004.
5. MUET, November 1997, Symposium on Left Bank Outfall (LBOD) Project and its Impacts, Symposium Proceedings.
6. Sohag, Mahessar etal. Conducted (2005) on pollution on Indus Waters and the Drainage System of Sindh, published paper in proceedings of Environmentally Sustainable Development in International Conference, held by Department of Environmental Science, COMSATS Institute of Information Technology, Abbotabad

The 4th Asian Regional Conference &
10th International Seminar on
Participatory Irrigation Management

Tehran-Iran 2-5 May, 2007

Theme 3

Support System for PIM Sustainability

GENERAL REPORT ON THE THEME "SUPPORT SYSTEM FOR PIM SUSTAINABILITY"

A. Hafied A. Gany[1]

INTRODUCTORY BACKGROUND

Out of obout 315 abstracts that had been submitted, 95 papers that have been accepted for the "4th Asian Regional Conference" and "the 10th International Seminar on Participatory Irrigation Management, and about 50 papers for History Seminar for presentation, or about 135 papers altogether. There are 44 papers belong to Theme 1 (A Review on Participatory Measures in Irrigation); 23 papers belong to Theme 2 (Required Grounds and Facilities for PIM Formation); and 28 papers belong to Theme 3 (Support System for PIM Sustainability).

On top on these figures, there are nine key speakers to give highlights of the underlying issues on PIM. Among others: (1) Problems and perspectives of PIM under the Small Land Holding Condition (INPIM-INA); (2) Irrigation Management Transfer (IRAN); (3) Irrigation Management Reform; (4) Success and sustainability of PIM (INPIM); (5) Performance PIM (FAO); (6) The Impacts of Management Transfer; (7) Experience on Management Transfer (The World bank); (8) Water Users, Participatory Management and Sectoral Reform (IWMI); (9) International Networks on Participatory Irrigation Management (The World Bank).

The present general report has been abstracted from Theme 3 giving special scrutiny on "Support system for sustainability of Participatory Irrigation Management". Out of which, 21 papers are accepter for oral presentation and seven papers for poster presentation.

Based on overall review of the 28 papers on Theme three, the issues have been grouped into sin major sub themes, which are highly relevant with the theme, despite that some particular aspects are unavoidably "overlapped" to some extent with other themes. This report, therefore, fucuses a special scrutiny on these six sub-themes (sections) with some interrelated context with the other two themes. The issues are highlighted in Section 7.

1- A. Hafied A. Gany, Ph.D., P.Eng., is a Board of Director of International Network on Participatory Irrigation Management (INPIM); Pesident of the Indonesian Chapter of INPIM (INPIM-INA); Vice President of the Indonesian National Committee of ICID; and the member of History Working Group of Irrigation and Drainage of International Commission on Irrigation and Drainage –ICID.
(General Reporter) - gany@hafied.org; hafiedgany@gmail.com

The general outline of the report based of grouping in somewhat random order, are highlight as the following groups: (1) Institutional Aspects, Constraints, and Opportunity; (2) Concepts and Analysisis of Public Participation; (3) Sustainability of Participatory Irrigation Management; (4) Evaluation of Irrigation Project Performance; (5) Impacts of Socio-economic development; (6) Capacity Building; and (7) Salient highlights of the papers on the theme “Support System for PIM Sustainable”.

I. INSTITUTIONAL ASPECTS, CONSTRAINTS, AND OPPORTUNITIES

1.1. GENERAL REVIEW

Under the variety of modes, participatory irrigation management has been implemented in many parts of the world over the last few decades. The implementations have been reportedly been indicating positive results. These particularly true for the newly completed projects including among others: (1) irrigated agricultural performance; (2) resource mobilization; (3) quality of irrigation services; (4) maintenance of irrigation infrastructures; and (5) farmers’ institutional development, and other such implementation achievement.

However, there are a number of evidences suggest that sustenance of such gains over a long run is often debate-able especially under the poor institutional conditions with the short-lived project activities. In fact, the continuation of external support should be continuously provided for a period of time before the capability of the community to manage the project on self sustainable basis. These external supports among others are: (1) supporting policies and strategies; (2) capacity building, training, and extension; and (3) monitoring and evaluation.

1.2. INSTITUTIONAL ARRANGEMENT

From the perspective of institutional arrangement, there are at least three significant and complementing actors: national/provincial governments, irrigation agencies and/or water users associations, and the irrigators. The institutional linkages among the three governance levels of responsible actors are evident.

In Nepal for example, the experiences so far indicate that the transferring management to farmers has been a huge experiment. Overall, the process has been positive, but more needs to be done to achieve the desired objectives.

In the past several attempts have been made to introduce a system to collect water fees from the farmers but without much success or long lasting. Therefore, whether gains in irrigated agricultural performance in PIM/IMT sites can be sustained is questionable. In the past, due to insufficient resource allocation for regular maintenance, irrigation systems fell into disrepair soon after rehabilitation and needed to be rehabilitated within a few years.

With regard to effective functioning of the WUAs, one difficulty is to locate strong leadership in the community and create an enabling environment for its emergence by creating favorable linkages with contributing actors. This is particularly relevant to the cases in which various supports are extended in the name of supporting PIM/ IMT initiatives through short-lived donor-supported projects.

Despite that the refine Goals and Objectives of PIM/IMT foresees improvement in agricultural performance and reduction in government expenditure. However, for last several years, clear and measurable objectives are not yet laid out. In fact, transferring the irrigation system over to WUAs in itself is perceived as one of the objectives in contrast to defining the impacts and results that are expected from the management transfer. For example, experience in Nepal suggest that greater farmer participation in water supply and system management; increased contribution of farmers' resources to operate and maintain the systems; higher agricultural production; and a more positive farmer perception towards water delivery services. The main threat, however, is the lack of sustainability.

1.3. SUSTAINING THE POSITIVE ACHIEVEMENTS

To ensure a sustainable positive impact, the state needs to give much more attention towards issues such as: (1) Sufficient resource allocation for O&M (be it from farmer contributions or government subsidies); (2) Ways to locate good leadership in the community and create an enabling environment for its emergence; (3) Focus on institutional development of WUA before rehabilitation, as preconditions before starting technical works; (4) Post transfer support: DOI should broaden its role of 'irrigation system manager' towards 'support service provider'; and More (human and financial) resources allocated to ensure a functional monitoring and evaluation (M&E) system to monitor impacts of PIM/IMT.

1.4. OPPORTUNITY FOR EFFECTIVE INSTITUTIONAL ENHANCEMENT

An important area which is sometimes overlooked in the design of IMT programs is the support system for WUAs and irrigated agriculture during and after management transfer.

Planners need to consult with water users about what support services are most needed by the farming community in order to assume the new responsibilities and tasks as well to overcome constraints.

Support services during and after management transfer may include advisory services about institutional arrangements, establishment of organizational and financial procedures and skills, credit facilities, legal advice, marketing and construction procedures.

Training and extension are amongst the most important tool to develop the knowledge and skills of farmers and enable WUA officials to undertake management responsibilities and to ensure more profitable irrigated agriculture.

1.5. FARMERS NETWORK FOR WATER SECTOR REFORMS IN SOUTH INDIA

This paper deals with practical experiences of one of the fundamentals of PIM i.e. Farmers Network for Water Sector Reforms (FNWSR) in South India undertaken by JalaSpandana.

The main objective of FNWSR is to facilitate farmers – the major stakeholders in irrigation to participate effectively in the political process of policy formulation and implementation. INPIM supported JalaSpandana to carry out FNWSR in 2004 and 2005.

The results in terms of regular interaction with the concerned Ministry and Bureaucracy, pressure group to lobby for PIM, motivate fellow farmers to function efficiently at various levels of WUAs, seem alarming. In Andhra Pradesh, FNWSR succeeded in building pressure on the government and ensuring the continuity of WUAs. In Karnataka, the members of FNWSR succeeded in effective formation and functioning of project level WUAs institutions in four major irrigation projects.

The analysis concludes that the farmers network is the pre requisite for the success of PIM that warrants devolution of power from department to water users. In this context the FNWSR not only enables negotiate and contest with the government agency but also facilitate building consensus and cooperation from fellow farmers. It is evident from the evaluation that the FNWSR has created considerable impact on PIM through creating awareness among farmers, direct interaction with the policy makers, facilitating implementation process, with limited financial resources.

1.6. FORMULATION OF COMMUNITY DEVELOPMENT PLAN IN SEMI-ARID ZONE

This paper presents agricultural and rural development policy of the Government of Morocco in the arid region located at the southeast of the Atlas Mountains.

Given the severely lacks rainfall, with only 50 to 200 mm per annum and agricultural activities are fully dependent on torrential water and groundwater through subsurface tunnel structures, referred to as the “khettara" (system resembles tertiary canal of a large irrigation system in end water distribution system) in Morocco.

The khettara system has been well operated for several hundreds years because community itself was established on the basis of khettara water. Since the khettara flow is indispensable to maintain communities in arid region, it is desirable to improve present situation through efforts of local people with assistance of local governments considering the major significance of the khettara rehabilitation, i.e., (1) less cost and safer water sources; (2) sole water source for stable agricultural production; (3) source to preserve social system; and (4) heritage for the future.

In the light of these facts, it is expected that the Government will continuously support communities and unify them into more large organization such as "communal society" to stabilize and increase farm income of the rural communities under their initiatives.

II. CONCEPTS AND ANALYSIS OF PUBLIC PARTICIPATION

2.1. COOPERATIVE MODE OF PUBLIC PARTICIPATION

Based on experiences, the locals' participation in water resources utilization is not differed from other forms of public interactions. For public project, however, financial support by the governments plays a great role in the completion of this kind of project, and the absence of the public in these projects can be a remarkable weak point.

One of the effective ways in water resource development is through public participation such as on public in scheduling, construction, completion and maintaining the projects. In East Azerbaijan, for instance, the participation of the public in completion and maintenance has been initiated through cooperative approach referred to as Water Supplying Cooperative Companies (WSCC).

Through the WSCC, public participation has been implemented by means of socio-economic and management to benefit from the water resource projects. Through the close interaction with the authorities within the framework of the WSCC, the effective life of the projects has been increased and a better use of soil and water resources. The case of East Azerbaijan is considered as a successful model for public participation.

2.2. PERFORMANCE STUDY OF PARTICIPATORY IRRIGATION MANAGEMENT

A performance study has been conducted in Orissa State, India to examine the functioning and otherwise of Water User Association (WUA) or Pani Panchayat in India promoted by the State and the local traditional irrigation institutions. The study objectives are; (1) to contrast the formal and informal institutions in terms of their formation, performance and success, (2) to examine about the peoples participation and their liveliness, and (3) to recommend policy interventions to make the formal institutions more successful.

The study observation concludes that the Pani Panchayat as regulatory institutions in charge of water distribution on equitable basis, their performance has been reasonably weak and unsuccessful. Even though Pani Panchayat has been initiated and endorsed in the State for more than a couple of years, the acceptance of the model have been lethargic and scattered. However, the study showed that co-operation increases with increase in farm size.

Researchers have drawn up a strategy for policy makers to ensure IMT programs become more pro-poor stressing the need to clearly define the rights of farmers, raise awareness of these rights, reform the election process, and monitor participation in water user authorities.

As a whole WUA an unexecutable and unacceptable, and is not in the interest of the people. There are so many constraints like selfishness, illiteracy, no interest due to big landowners, which hinder for the improvement of WUA.

A detailed action plan should be prepared in consultation with the water users through Participatory Rural Appraisal method. It is necessary to apply bottom-up approach instead of top-down for sustainability. Simpler procedures are needed that still provide the WUA organisations with sufficient legal standing to deal with government agencies, contract with private firms, contractors, and control resources within the group.

2.3. PERFORMANCE EVALUATION OF NEW IRRIGATION PROJECTS IN ZANJAN PROVINCE, IRAN

Increasing water efficiency in agriculture part is the most important solution to reduce the negative impacts of water crisis. The most important aspect to put into effect is that the new irrigation project has to be based on appropriate programming as well as performing of irrigation designs and projects implementation.

An evaluation study has been conducted in Zanjan Province, Iran concludes that the performance of new irrigation projects have been ranked into four levels including excellent, good, moderate and weak. The overall evaluation of projects in zanjan indicates that the weakness from the qualitative analyses, while the evaluation indicate the good performance from qualitative. From these projects, three successful contribution projects have been identified, however, the performance evaluations from pressured irrigation in third program in Zanjan Province, the study concluded that these projects aren't conformities in contribution degree from quality point.

From this evaluation, some recommendation for future implementations are as follows: (1) The projects have to be equipped with data base networks from national water sources with appropriate quantity and quality as well as time accuracy; (2) Water measurement networks must be effective to support appropriate water resources allocation; (3) Improvement of irrigation efficiency and water utilization is most important aspect to consider; (4) Implementation of artificial feeding projects by groundwater during the non culture seasons; (5) consistent assistance to water users association for improving operation and maintenance; (6) The result from studies about comparing evaluation of pressured irrigation and difference in irrigation efficiency, it is potential in pressure way to use more lands from irrigated farms.

2.4. FARMERS' PARTICIPATION IN IRRIGATION WATER MANAGEMENT IN NORTHEAST IRAN

A study has been implemented in Northeast Iran to investigate the farmers' participation in irrigation networks management with an approach to compare two groups of farmers in the irrigation networks with Water Users' Cooperative (WUC) and without. The methodological approach was a descriptive-correlational and causal-comparative study of the survey type.

The reliability analysis and the t-test with independent samples showed that there were significant differences in relation to the averages of the variables of status of farmers' participation in irrigation management, annual income, farmers' perception of rural irrigation status, social solidarity with some parameters.

According to the study findings, it was found that WUCs as the considerable social capital can improve the level of farmers' participation in irrigation water management.

Significant differences was statistically found between two groups of WUs, those who involved in irrigation network with WUC and those in non-WUA networks in relation to the individual variables of age, education level, and experience in agriculture.

Among the economic characteristics, there was a significant difference between two groups of respondents in relation to their annual incomes. Significant differences were found between two groups of respondents from the stand point of all their cultural and social characteristics, namely extension contacts, communication channels, social confidence, social solidarity, social participation, farmers' attitude toward the WUC, and farmers' participation status concerning irrigation networks management.

In addition, the analysis results indicated that among technical factors, there was a significant difference between farmers' behavior regarding farm water management and farmers' perception of rural irrigation status in two groups of respondents. Hence, agricultural policies in Iran must aim at raising the potential of water management technologies through the development of multi-functional WUCs to enhance agricultural water productivity, promote equitable access to water and to conserve the natural resource.

2.5. PARTICIPATORY MANAGEMENT OF MODERN IRRIGATION SCHEMES IN IRAN

A study of stakeholder views on the modern Dez and Moghan irrigation schemes has suggested farmers and extension staffs that the existing canal management is not sufficiently responsive to the new challenges of agriculture in the post-reform era, and that a more participatory management structure could help resolve the problems in water delivery.

Iran already has a long-standing and successful model for participatory farmer management in the millennia-old Miraab system (*Shaarebin*) used for managing the Karezes and Qanats in the arid and semi-arid regions of Iran. The survey responses indicated that all three stakeholder groups (farmers, extension staffs and water agency staff) would support the implementation of a management structure based on the Miraab system.

The research confirmed the importance of consulting different stakeholder groups, who might have different attitudes and perceptions of the problems and potential solutions. All the stakeholder groups surveyed indicated they would support its introduction, though some doubts were expressed in interviews about senior water agency staff.

It is suggested that farmer organizations should take the government's interest in irrigation management transfer as a window of opportunity to take up the stewardship of, initially, the tertiary water distribution system. They should use their indigenous knowledge to achieve the flexible demand management required for viable modern farming.

The commitment of farmers and support of other stakeholders are both crucial for success of the Miraab systems in the new working context. Successful management of the tertiary canals would be a good start for the ultimate establishment of the full farmers' stewardship of the main and secondary canals in the future.

2.6. PIM OPTION FOR GROUNDWATER

Given the fact that a large sector of the irrigated area is totally or partly dependent upon groundwater, in Iran, groundwater has also become a cornerstone of many regional economies and societies.

A study has been conducted to study analyzes the situation of groundwater resource use in the Abshar irrigation system in the Zayandeh Rud Basin, Iran and establishes the question if participatory management of groundwater and conjunctive use is a viable option for irrigation management in the present context.

This paper intends to trigger the thought on whether through participatory groundwater (or conjunctive water) management it is possible to establish control measures for groundwater management in a case such as the Abshar Irrigation System or any other area where groundwater exploitation levels form a threat for the sustainable use of groundwater.

The remaining questions to be established among others: “Is participatory groundwater management within and outside of surface water irrigation systems a feasible solution?”

If so, what knowledge is needed? What social structures are needed and at what scale? How should responsibilities be established and who should be responsible for what? What role should be delegated to the state? What role should be delegated to the water management agencies? What responsibilities should go to user organizations and how do you organize these? Is there a need for institutional engineering? The subsequent answers to these questions would provide feasible options for PIM on Groundwater.

2.7. PARTICIPATORY IRRIGATION MANAGEMENT IN IRRIGATION NETWORKS OF TEHRAN PROVINCE

Participatory Irrigation Management in the section of irrigation and agriculture in the wide land of Iran with water scarcity has a long history. After the victory of Islamic revolution of Iran government provided a fast development in water industry in the demand of work in a way that the resource dams which are under operation and use are more than 170 national dams in provinces and about 83 national resource dams are being built.

The process of participatory management shift has been done either by voluntarily establishment of people or it has been done by the application of government, so they have been able to use this design through actual field performance.

As far as the previous experiences in Teheran Province, there are a number of problems and constraints associated with PIM implementation. These are among-others: (1) limitation of authorities and legal instrument as well as support system; (2) Unclear water right (3) Diversified water policies causing problems on the management shift in the cities of Tehran Province; (4) Lack of successful PIM model the purpose of attracting people participation; (5) Lack of sense of ownership and responsibility in PIM implementation; (6) Lack of inter-sectoral coordination; (7) Highly dependence on the government on the water services; (8) Problem of land conversion from irrigated agricultural lands to industrial, housing and other non agricultural purposes; (9) Lack of initiative for proper maintenance of irrigation infrastructures; (10) Lack of public awareness on the appropriate use of safety facilities provided for irrigation infrastructures.

2.8. APPLICATION OF PROPORTIONAL PLUS RESET (P+PR) AUTOMATIC CONTROL SYSTEM FOR PARTICIPATION OF WATER USERS IN DELIVERY MANAGEMENT

Facing water shortage and increasing water demand, it is necessary to consume limited water resource in an optimal fashion. Due to low performance of irrigation networks improvement, water delivery systems and its performance with participation of water users and applying improved control system become a must.

For this purpose in recent decades several automatic control Systems including P+PR system, for flow management in irrigation networks have been introduced. Applications of these techniques provide situation that, water users play a direct role in water delivery with high flexibility.

To test the performance control in this study, the ICSS hydrodynamic model has been applied on ASCE standard canal number two to test the global performance of P+PR downstream automatic control system.

The results show that average depth deviations are in the range of 0.001 to 0.014 % and maximum depth deviations are in the range of 0.111 to 0.211 %. The response time of control system shows that the depth is stabilized in the allowable range at the first time step. Performance indicators and depth variations demonstrate appropriate functioning of the control system.

Relying on the results of this study, application of this control system in irrigation canal which provide higher flexibility and direct participation of water users in management of water delivery could be suggested.

The study concludes that the performance of developed P+PR automatic downstream control system for simultaneous and significant diversion variations of outlets is quite suitable and it could be used as an effective instrument for direct participation of water users in management of water delivery.

2.9. PARTICIPATORY IRRIGATION MANAGEMENT IN MAHARASHTRA STATE, INDIA

Maharashtra has long tradition of farmers' participation in irrigation management in the form of Phad systems and Malgujari tanks. In the nineties, the first Co-operative Water Users Association (WUA) was established in the Mula Irrigation Project. With its success, Government of Maharashtra (GoM) has been promoting PIM in the State. Over the last 10-15 years, there was appreciable growth in WUAs. There are number of success stories, underlining the importance of WUAs. On the other hand, there are also some instances of no appreciable improvement in performance of irrigation projects with WUAs.

The study was concluded to evaluate the actual performance of WUAs a study was conducted with some conclusion as to provide insight into hindrances in functioning of

WUAs and measures to improve its effectiveness, which in turns improves the performance of irrigation projects.

It reveals the reasons behind the slow progress and also highlights important learning and challenges to upscale PIM in the State. GoM has initiated series of reforms to strengthen PIM. A stand-alone act (MMISF Act - 2005) has been enacted to provide legal backing to WUAs. The water for irrigation to be supplied volumetrically through WUAs only and there will be legal agreement between WUA and competent authority. The State has gone further in providing water use entitlement to individual farmers and establishment of independent water resources regulatory authority to ensure judicious, equitable and sustainable management of water resources of the State.

It is observed that Irrigation management transfer improves the service delivery as well as financial performance of the Project. There is need to have committed support from WRD and timely efforts to build WUAs to shoulder the responsibility. The Maharashtra case study provides insight into important aspects of PIM and possible measures to strengthen WUAs movement. Though Maharashtra approach to PIM is gradual, but with reforms in place and changed mindset of officers of WRD and farmers, PIM could lead to sustainable irrigation management.

2.10. PARTICIPATION OF THE FARMERS ON O&M OF IRRIGATION NETWORKS IN CENTRAL JAVA AND WEST NUSA TENGGARA PROVINCES, INDONESIA

Under the new law on Water Resources No. 7/2004 and the Government Regulation on irrigation No. 20/2006 in Indonesia, the central and local governments recognize the role of the water user associations (WUAs) to carry out the irrigation networks system management based on farmers' participation approach.

This paper elaborates several researches for analysis and evaluation of the farmers' participation on operation and maintenance of the irrigation networks system in two provinces in Indonesia: Central Java and West Nusa Tenggara.

This research gives general responses of the farmers' participation at the planning and performing processes respectively as indicating the scores of 2.77 and 2.80 and classifying the moderate categories as well as at the evaluating process as indicating the score of 3.2 and classifying the high category. The farmers' response on operation and maintenance of the irrigation networks system management in two provinces summarizes that 42% of farmers is categorized as high participation, 16% as moderate participation, 32% as low participation and 10% as very low participation.

Several other researches have been carried out for different locations in Indonesia for evaluation the farmers' participation on O&M of the irrigation networks system by different analysis methods and clearly concluding the positive impact. This synthetic research was carry out at six water districts in two provinces i.e Central Java and West Nusa tenggara, the results also showing that a good correlation between the farmers' participation and the performance of O&M of the irrigation networks system in Indonesia.

2.11. FORMATION AND DEVELOPMENT PROCESS OF PIM IN QAZVIN AREA

Since the last fifty years, gradual progression in management style of irrigation and drainage systems supported by promotion of people's participation in management trend has faced the government-oriented or hindering mechanisms to critical challenges at global scale. Genesis of this mind-set could largely facilitate evolution of change management through the four-stage process including: diagnosis, denial, cooperation and participation.

The network imitates a telescopic model in operation with hydro-mechanical diversion and checks (Amil) installed at its upstream. The Irrigation Management system in Qazvin (QIM) also follows full public governance as being experienced everywhere across the country. This traditional management, parallel to over-dated structures has left nothing but a depreciated and inefficient network in Qazvin.

A holistic plan for capacity building and empowerment of local farmers was founded in the province to develop a participatory management and promote due changes towards optimum utilization and maintenance of the network. The initiative is reliant on a tree-shaped model and consists of: farming groups, water users associations, unions and their apex Federation at provincial level. Upon direct election of farmers' representatives and formulation of legal instruments, managerial and maintenance affairs in main and lateral canals were gradually transferred to the local clients.

Presently, many commitments encompassing structural rehabilitation and water distribution have been shifted to the farmers in Qazvin, followed by logistic and administrative works handled by private sectors. Dynamic involvement of the young generation (men and women) at managerial and technical levels scattered at WUAs branches or Federation posts remarks for outstanding aspects of the PIM system in Qazvin.

To date, the mode applied for creation of CBOs (community-based organizations) and legislation of NGOs in terms of Water Users Association (WUAs) in Qazvin, generates a national pattern over the state.

2.12. RESEARCH PROJECT FOR IMPROVEMENT OF PIM (THE TAFILALET AREA, SOUTH-EAST OF MOROCCO

The research project for improvement of PIM is a concrete follow-up of the Rural Development Project in the Tafilalet (PDRT). The Tafilalet is located South-east of Morocco, in the pre Saharan, south-of the Atlas mountains zone and extends over an acreage of 77 250 km^2, of which 60 000 ha are under irrigation.

During a mission carried out in the area by experts from the International Fund for Agricultural Development (IFAD), it was deemed necessary to undertake actions to upgrade users' capacities to deal with management of irrigation infrastructures. Based on the results of the mission, plans of the research project for the improvement of PIM were developed and implemented. The project, financed through donations from IFAD ($US 490, 000), aims to set up prerequisites to make it possible for users to upgrade their intrinsic capacities through: (i) organizing themselves within Water Users

Associations (WUAs) where water resources are available; and (ii) meeting O&M costs incurred by irrigation systems.

A pilot action plan has been implemented in two small-scale irrigation systems falling within the scope of action of the Tafilalet Rural Development Project (PDRT). The project has targeted two localities Jorf and Tinjdad where the problem of water scarcity is most acute. The plan is based on the following three basic actions: (i) promoting adoption of partnership schemes involving various departments of the Ministry for Agriculture and users of water resources and rehabilitation of irrigation infrastructure; (ii) increasingly involve the Regional Office of Agricultural Development of the Tafilalet (ORMVATf) in providing supervision and technical backstopping to the WUAs and (iii) encouraging use of water-saving irrigation strategies.

During the four years of project implementation and while aiming at introducing new methodology and a new approach to prompt farmers to contribute to ensuring durability of irrigation infrastructure, the project has been able to reach almost all of the goals set down: (i) organizing and training farmers within the context of their WUAs; (ii) enhancing awareness by means of training courses and field trips; (iii) promoting water-saving irrigation strategies through practical demonstration plots and acquisition of logistics support; and (iv) setting up a database for follow-up evaluation of the WUAs' performance.

2.13. PRDA: A PARTICIPATORY METHODOLOGY FOR ANALYZING AND IMPROVING IRRIGATION PERFORMANCE – CONCEPTUALIZATION AND EXAMPLE OF APPLICATION IN KENYA

In Sub-Saharan Africa, agriculture is the backbone of the economy and employs approx 70% of the active work force. Rain-fed agriculture is largely dominant and agricultural production is increasingly vulnerable to erratic rainfalls and recurrent droughts. Although irrigation development is still in its infant stage in most countries and its performance remains largely below expectations of policy planners, it is believed it has a strong potential for rural development and economic growth.

The APPIA (is a French acronym for "Improving Irrigation Performance in Africa") project is implemented in several countries in Sub-Saharan Africa. One of the major activities of the project was to develop and test in the field a participatory methodology for analysing and improving the performance of farmer-managed irrigation scheme. This methodology has been named PRDA for "Participatory Rapid Analysis and Action Planning of Irrigated Agricultural Systems". A manual published by IWMI and the FAO presents the details of the methodology.

This paper describes briefly the situation of smallholder irrigation in Kenya and the numerous questions regarding the performance of such schemes. PRDA is then presented and a case study of its application in one Kenyan scheme is given. In conclusion this paper suggests a set of recommendations for effective use of PRDA based on the lessons learnt in the African countries where it was tested. Based on the results obtained during the course of the APPIA project, the present document suggest that PRDA may be one tool to achieve successful participatory irrigation management that can be used by multi-disciplinary/multi purpose organization such as National Irrigation and Drainage Committees.

Technicians and policy makers realized that there was no organization in country that can address all issues related to irrigation management. Hence the Ministry of Water and Irrigation decided the formation of a professional association to enhance networking amongst irrigation players, implement multi-disciplinary approaches and develop further Research & Development programs. In countries where they exist this could be one role of the National Irrigation & Drainage Committees.

III. SUSTAINABILITY OF PIM

3.1. MEASURING OF SUSTAINABILITY

Many resources have been spent on analyzing and standardizing an approach to introducing PIM. However few resources have been allocated to developing indicators for monitoring and evaluation (M&E) of the performance of WUAs. The sustainability of WUAs within the specific socio-cultural context of the countries in which they have been introduced/developed requires more consideration.

Given special scrutiny of the themes on international experience with measuring performance of WUAs; common pitfalls for sustainability of WUAs; and main technical and institutional indicators for measuring WUA performance, it has been concluded that the institutional arrangements for M&E of WUA performance, such as Federations of WUAs, the role of national, regional and local authorities in measuring WUA performance and the maturing of PIM as a process of development.

This conclusion puts forward a hands-on approach for policy makers, implementation experts, academics and consultants for ensuring and improving the sustainability of PIM.

3.2. STRATEGY FOR PIM SUSTAINABILITY

Participatory management in irrigation is among the burning issues for discussion in recent decade for exploiting the irrigation and drainage networks of different countries irrespective of their involving infrastructural facilities.

Considering the competition in consumption of agricultural water and optimum use of accessible water resources, a study has been conducted based on the assumption that the governmental management faces serious challenges in meeting the needs of users, while the private sector looks at it doubtfully because of high risk in investment on agricultural water. The study for creating participative irrigation management has been conducted in Foumanat Irrigation Network (Gilan Province) and Soufichai Irrigation Network (East Azerbaijan Province).

The Foumanat Irrigation Network is a network with an age of more than 30 years and covers an area approximately 50,000 hectares. The main crop of the area is rice. Soufichai Irrigation Network is about eight years old and covers an area about 12,000 hectares. The main crops of the area are cereals and fruits.

The study concludes that the strategy for PIM sustainability must be perceived that operation and maintenance of irrigation networks is not independent from ways of participation in rural and urban societies.

The ways and degree of participation in irrigation networks have to be seen from two major considerations: The first that the degree of willingness of the mother exploiting company to assigning part of its responsibilities and the second is the users who are going to accept the responsibility.

For explanation of common issues especially the ways of allocation and distribution of water in irrigation networks, both these aspects must be equipped with analysis instruments, which has to be able to demonstrate water allocation to each system that would resolve the competitive use of water amongst the users.

3.3. MICRO-PLANNING IN PIM, AN ENTRY POINT FOR SUSTAINABILITY

The necessity of devolution of certain management responsibility of irrigation system to the farmers' organization is now widely accepted as an effective tool for sustainable irrigated agriculture.

In India during 1990s systematic institutional and organizational changes have been undertaken to increase farmers' participation in irrigation management through formation of Water Users' Association (WUA) or Pani Panchayats under different externally assisted economic restructuring and irrigation infrastructure development programmes of World Bank, European Commission, Japan Bank for International Cooperation.

Today, Participatory Irrigation Management (PIM) at various levels is being implemented in different types of irrigation systems. For this program, appropriate institutional arrangements and mechanisms to bring about efficient utilization, equitable distribution and sustainable irrigation service are framed by different states of India.

From a number of experiences learned in Orissa, the poorest state in the dominion of republic of India, concludes that the strategic micro level planning along with identified entry point implementation program that are undertaken for sustainable irrigated agriculture simultaneously.

The study concludes that the objective of poverty reduction by way of promoting schemes for agricultural productivity improvement through irrigation can be achieved by adopting community based participatory approaches that support agricultural development like improving irrigation performance. These could be achieved by employing new production technologies, enhancing access to markets, promoting environmentally sustainable production activities, having gender perspective, measures to improve income and livelihood through micro-finance, rural infrastructure up-gradation, and participatory processes to empower the rural poor.

3.4. THE NECESSITY OF FARMERS PARTICIPATION IN PRESSURIZED IRRIGATION SYSTEMS FOR PIM SUSTAINABILITY IN IRAN

As a developing country, Iran has several large-scale irrigation and drainage networks under study and operation. These networks are often constructed in small-scale farmlands, and because of water deficit, inappropriate topography and incentive policies, they are equipped with pressurized irrigation systems in which operation is more complicated, comparing with surface irrigation method.

On the other hand, government policy is to develop private sector and therefore transferring operation of the networks to farmers' organizations is highly considered. Most importantly is the availability considerable costs of project execution which is provided by public credits also bank facilities by farmers' commitment establishing a sustainable PIM is highly important.

Nowadays, national policy is often accelerating construction in large-scale pressurized irrigation projects, as a result all components of pressurized irrigation systems being performed by government, so farmers do not play such an important role in this process. This theorem would cause some problems in transferring the irrigation system management to farmers' organization.

The study results obtained from performing under pressurized irrigation systems by government is compared with the one constructed by farmers organization, also offers some suggestions with regard to changing the present procedures and participating farmers organizations in project execution.

The study observation conclude that the pressurized irrigation projects in large areas which are constructed in small scale farmlands, all of the project execution are done by government and after accomplishment of project execution, will be transferred to farmers organizations. Nevertheless this approach will result in farmers' irresponsibility, and it will, in turn cause their dissociation during project operation so that after transferring the system to farmers' organizations, farmers will ascribe the organizations' managers to be responsible for all the system's problems.

3.5. SUSTAINABLE PARTICIPATORY IRRIGATION MANAGEMENT

To make proper decision on irrigation management transposition, "sustainability in irrigation management" and specifically PIM, which is the result of transposition program should be taken into consideration.

In irrigation management transposition process, as the management transposition mechanism and the assured responsibility delegation method are important, the sustainability and persistence of activities are the main issue. Specially, since the stakeholders as the future caretakers for operation and maintenance of irrigation installations do not have enough experience for the acceptance and performance of the given responsibilities. Therefore, the persistence of these activities in the form of new operational system, which is the subject of sustainable management, is focal point of the transposition program.

The main elements in the sustainable participatory irrigation management are: (1) Strategies; (2) Training and Extension; (3) Monitoring and valuation.

In all the three abovementioned main elements, it is recommended that the rational advisory models to be substituted for the common governmental trends, which requires: (1) In policymaking, new guidelines with no consideration for administrative caution, but correspond to requirements of local developing society to be submitted; (2) In training and extension, in addition to formal education in agricultural and irrigation activities, the issues relevant to reconciliation of technical specifications of the network with social requirements of an operation unit to be clarified for the stakeholders; (3) By the assistance of a specialized support system (e.g. in form of a non-governmental specialized/advisory organization) a diligent plan for monitoring and valuation of the performance of modern management to be designed to overcome the conditions resulted from establishment of the participatory operational policy instead of the past one.

IV. EVALUATION OF IRRIGATION PERFORMANCE

4.1. PERFORMANCE EVALUATION OF NEW IRRIGATION PROJECTS (ZANJAN PROVINCE, IRAN)

In an attempt to evaluate the water efficiency in agriculture it's necessary to focus our best tries on programming and performing irrigation designs and projects. From evaluation in irrigation new projects in five years third program in Zanjan Province the results of effect amount have been ranked in four levels including excellent, good, moderate and weak. Nevertheless, projects have been evaluated in as weak in quantitative term but good in qualitative term, and from these projects, three successful contribution projects have been elected and introduced in this article.

The general suggestion noted that in order to motivate in investors, it's necessary to use encourage policies for using new irrigation approaches.

Regarding to performed evaluations from pressured irrigation in third program in Zanjan Province, it was realized that these projects aren't conformities in contribution degree from quality point.

Learning from experience of the project implementation, the following aspects are recommended: (1) Water resources data base must be provided accurately from quantity and quality aspects; (2) Water measurement networks installation must be improved to ensure better irrigation management; (3) The increase of irrigation efficiency could be achieved by appropriate irrigation water operation; (5) On pressured irrigation it's necessary in pressure way to use more lands from irrigated farms.

V. IMPACTS OF SOCIO-ECONOMIC DEVELOPMENT

5.1. IMPLEMENTING PIM MANAGEMENT IN THE LITERATE STATE OF INDIA

Kerala, elongated coastal state of India, lags behind many states in the country in participating farmers in the management of irrigation, and implementing PIM.

Government manages the irrigation projects and distribution of water to its 0.3 mha irrigated area, which includes wetland crops like rice, and garden land crops like coconut.

Fragmentation and subdivision of land and resultant small size of holdings (average 0.3 ha); part-time cultivation of farmers who are literate (literacy rate 91%); lack of sufficient labour availability and high labour cost; and lack of coordination among various departments are the major threats to irrigated agriculture in Kerala.

PIM pilot projects being implemented at Neyyar and Malampuzha Irrigation Projects of the State have shown that, in spite of all the above issues, farmers are highly motivated and are ready to share responsibilities of PIM. Since spouses of farmers are also inducted as members of WUAs, enthusiasm shown by women in managing irrigation is encouraging.

The pilot project experiences are also encouraging. But the hesitation of officials to depart from the existing system, the reluctance of operational staff to involve users in management, and lack of legislative backing, are the main blocks noted.

The observation concludes that there are several problems that may hinder the implementation of PIM in Kerala, as mentioned above. But prospects are not too bad, as there are several contributing factors. If the irrigation agency supports and nourishes, PIM will nourish in Kerala also.

Almost at all levels, it is accepted that there needs a change. But their apprehensions regarding job security and loss of mandate compel them to opt for maintaining the status quo or keep away from the efforts to initiate change. It is expected that the lessons learnt from the pilot projects on PIM may help to gear up the political and administrative will to counter this.

5.2. PARTICIPATORY EXPERIENCES FOR ENHANCING LAND AND WATER PRODUCTIVITY

This paper shares the experiences of a project having measures to facilitate the formation of land and water management strategies and institutions that are socially acceptable and broadly replicable.

The paper describes the participatory process developed and adopted for exploring options for better use of water with focus on a single distributary RPC-V (Right Parallel Channel – V) of Patna Main Canal system through cost effective participatory mechanism, involving poor farmers, landless and share croppers.

A key difference in the present approach has been the identification and elaboration of possibilities of bringing improvement through dialogue with poor and marginal stakeholders empowered in relation to the larger-scale farmers who traditionally dominate the on-farm water management (OFWM) through self-help groups (SHGs). Dialogues were initiated between experts, local communities, and other key stakeholders such as the Irrigation Department.

The paper concludes that peoples' participation has been identified as one of the major principles for sustainable development of water resources. This reflects to believe that people who inhabit an environment over time are more competent to make decisions. Dynamic nature of land and water invites wide range of stakeholders having multiple interests leading to complex integration amongst them. Establishing dialogue amongst these stakeholders needs identification of appropriate processes and means through which they can be brought together for a common goal.

The experiences in collaborative project and wide range of project partnership reflects that participation with community members on land and water related issues is mainly focused on two general types of situations: (a) set of issues focusing immediate and critical concerns leading to short-term emergencies or gains such as; irrigation needs, eradication of seasonal water logging and falling crop yields and (b) concerns that provide opportunities to different stakeholders to come together for longer-term, precautionary issues.

To achieve these goals the perspective should be broader which may accommodate members from wider constituency.

5.3. IMPACTS OF FARMERS' NGOS ON SOCIO-ECONOMIC DEVELOPMENT OF QAZVIN AREA, IRAN

Connoisseurs believe that inefficient management in O&M of irrigation system is assumed as a key element in weakening irrigation performance. Based on experiences, removal of existing inconsistencies and challenges will not realize without people’s participation.

The analysis in this article have been made to formulate and implement a strategic plan for establishment and operation of NGOs (Non-Governmental Organizations) in Qazvin plain mobilized by face to face communication towards further involvement of his staff (Qazvin Irrigation Management, QIM) and target farmers in the process.

Based on a timing schedule, an action plan became operational to gradually shift exploitation and maintenance of existing irrigation-drainage network to the local community. Various commitments e.g., selling, inspection, registration, distribution and delivering water quotas are to be implemented by corporate Water Users Associations. They are also obligated for maintenance, dredging, and fixing hydro-mechanical segments (Amil) and turn-out structures.

The local leaders, apart from foregoing services and continued inspection of structures and operational processes, are responsible for fulfilling the demands, settling the problems on the spot and preparing daily reports on possible offending in the network.

Implementing IMT (Irrigation Management transfer) initiative in Qazvin, has resulted in numerous cultural, social and economic impacts especially in the area of improvement of irrigation management and has created structural changes towards the great objective i.e. "Equitable distribution of water" in the network.

5.4. PIM, POVERTY AND MODERNIZATION OF FARMER'S ORGANIZATION (FO) MANAGED IRRIGATION CHANNELS IN SINDH, PAKISTAN

The concern of this paper is to assess the role of FOs in managing and implementing the investment and modernization schemes of their own managed channels under PIM in Sindh province of Pakistan. The paper seeks the contribution of PIM modernization intervention in reducing the poverty, equity in delivery of water service and sustainability of FOs. The paper then focuses on the current PIM concepts, reform, and its process. The paper also address the issues of rehabilitation works, contract management.

At present at least 180 irrigation channels have been transferred to FOs for management and operation followed by assessment and collection of water service charges. The FOs have also been given an opportunity to implement and undertake the rehabilitation and modernization schemes for improving channels maintenance and operation.

The overall analyses concluded that PIM has evolved and become generally accepted as a necessary aspect of productive and sustainable irrigation. The schemes of modernization of irrigation channels are an excellent opportunity to address the issues of sustainability of FOs, sustainable water resource management. The FO managed investment schemes have not only addressed the local employment issues of landless agriculture and rural worker but also has addressed the water equity and efficiency as well.

The increased farm productivity and income has reduced poverty from the rural poor. In Sindh PIM has proved to be successful model. But it is long way to go and government still needs to support and create support services for sustainability of reforms in Sindh. An empowerment model has to be followed and enabling environment for these new institutions has to be created.

There is a need to maintain the transparency and create support service for institutions created under reforms, particularly FOs and water management agency.

5.5. VOLUMETRIC PRICING OF IRRIGATION WATER IN INDIA: EXPERIENCES AND LESSONS LEARNED

Volumetric method of pricing irrigation water has always been advocated as the better approach to induce water savings by farmers. However, owing to seemingly technical and administrative complexities in adoption of the volumetric method - especially in large public canal irrigation systems, the area based pricing method is widespread in most countries.

In India, during the last decade, there has been significant development in adoption of the volumetric supply and pricing through PIM. Present paper provides a brief overview of international practices and the present status of irrigation water pricing and PIM in India. A case study of volumetric allocation, supply and pricing adopted by a Water User Association (WUA) in the State of Maharashtra has been presented.

The experiences and lessons learned from the case study and similar other WUAs have clearly demonstrated that a combination of volumetric supply and pricing at the entry point of a WUA command area and subsequent distribution and recovery on crop-area-season basis by the WUA can become successful. Although, the much perceived objective of achieving water savings due to the volumetric pricing was not directly realized, there prevails a win-win situation both to the government department staff and WUAs /farmers. For irrigation staff, this approach has minimized the efforts in area measurement and vigilance on the area irrigated by farmers, and billing of irrigation charges has become simpler.

From farmers' side, as there is a full freedom of cropping pattern and the volumetric water charging system being transparent, they are willing to pay higher rates and use the available water efficiently by irrigating more area with same amount of water. Nevertheless, there is a vast scope to refine /upgrade the present system, especially in respect of increasing the accuracy and reliability of flow measurement.

The concept of volumetric supply can gradually be introduced at individual farmer's level by roping in available technology and farmers' involvement. There is a particular need to strengthen the role of WUAs to equip them for the enhanced responsibilities which calls for a major capacity building exercise.

The Way Forward: Volumetric supply and pricing of irrigation water in India is still at experimental stage and has to go a long way before it becomes a widely accepted and an integral component of WUA's operation.

The case study has amply demonstrated that farmers are willing to pay higher water charges provided the supplies are reliable, flexible, equitable and there is a transparency in the billing system. In the Waghad project, a few WUAs have gone one step ahead by practicing internal distribution of water on hourly basis instead of crop-area basis (proxy volumetric approach).

Nevertheless, the political will, quality of service, and leadership are the *buzzwords* to make it happen. There is a need to make the flow measurements more accurate, reliable and the structures more robust. The flow measuring device may be equipped with an automatic water level recorder /totalizer to account for fluctuating flow rates and convert those into volumes.

Deficiencies in the construction and maintenance of the measuring structures need to be removed. Some innovative flow measuring devices may be tried. There is a need to provide water level regulating structures in the canal network to maintain stable flows at the measuring points. Capacity building and training of all concerned – Department personnel and farmers should continue. With the given scenario, one can hope of using volumetric water pricing as a tool to bring about water savings in reality.

VI. CAPACITY BUILDING

6.1. PARTICIPATORY TRAINING PROGRAM, IN ANDHRA PRADESH, INDIA

This paper deals on the field activity of participatory training program (PTP)/capacity building of various stakeholders undertaken by Jala Spandana in large canal irrigation projects in Andhra Pradesh, India.

Given the objectives as to strengthen PIM, sustain WUAs, enhance water use efficiency and livelihoods, the JalaSpandana Designed Participatory Training Programme (PTP), which build the confidence of farmers and other stake holders and produced good results in taking over the responsibility of collecting water tax/rates/charges, exploring alternates for efficient main system management, sustainable WUAs, tail end deprivation.

The trainings were carried out in an integrated approach to Integrated Water Resources Management (IWRM) with unlimited time bound program that is easy to encompass all the complexities of the irrigation system, which again could be registered by the participants.

Under the support of the Government of Andhra Pradesh. PTP has been extended to irrigation projects that are undergoing modernization program with huge expenditure. The representatives who were initially discussing only on physical works started exploring alternatives for efficient water management. Establishment of dummy/informal project level committees is yet another technique adopted in PTP.

Lessons Learnt: PTP is the right way of training program as different stake holders realize their roles and responsibilities and in three years period, the project committee of WUAs or Department officials show the sign of taking over the training as part of water management. The department officials and WUAs prove great potential to resolve majority of the issues including tail enders and operation and maintenance issue.

The **time** frame for PTP in these large irrigation projects given the magnanimity of the issues and work in large irrigation project **is inadequate**, the field experience shows that at least three years is necessary for NGOs to prepare the ground fully and **exit**.

The intensified PTP in large irrigation projects compounded with policy reforms certainly make PIM success in AP, particularly in the wake of policy making WUAs continuous body with every two years election to one third of the members.

INPIM may commission study on PIM in Andhra Pradesh both from policy perspective and field situations for the benefit of larger interest of PIM. Further, it would be appropriate for INPIM to support activities like Farmers Network for Water Sector Reforms and Develop PTP.

6.2. BUILDING CAPACITY FOR PIM - EXPERIENCES AND EMERGING ISSUES

This paper builds on established concepts of capacity-building to look in turn at the key dimensions of the policy environment, institutional strengthening and individual development. The importance of a consistent and supportive policy environment for building capacity for PIM is emphasized. A range of approaches to institutional strengthening are put forward, and their focus on the strengthening and development of Water Users Associations for PIM is discussed. Individual development is normally undertaken through training, but there is a clear need for innovatory and non-formal approaches to training, particularly to support PIM.

The paper then goes on to discuss water governance and social learning, as two key emerging issues of particular relevance to capacity-building for PIM. Water governance provides a framework for viewing PIM within the wider perspective of the water sector as a whole, while the current emphasis on social learning is particular relevant to concepts of participation and PIM, and provides an entry point for capacity-building through individual development.

Recent experiences collated through ICID workshops and elsewhere are reviewed for insights into capacity-building for PIM. These include experiences from India, China, Peru, and transition economies such as Ukraine and Albania, with reflective case studies from Pakistan, Bangladesh, Nigeria and Tanzania.

The paper draws on these experiences to develop some general conclusions in the light of the theory and concepts of capacity-building, in particular highlighting the need to take an integrated view of all the resources needed for capacity-building for effective PIM and the importance of better understanding of participatory processes and of learning at the local level.

This paper also analyzed the need for capacity building for PIM at the level of the policy environment, institutional strengthening and individual development. It discussed the importance and relevance of the emerging concepts of water governance and social learning to capacity-building for PIM. Finally it reviewed the experience of ICID and others in the field.

The general calculation is that the Institutional strengthening provides the most significant issues in capacity-building, and there is no blueprint for success. The outlined approaches to institutional strengthening which build on a set of design questions. The appropriate responses to these questions will vary from location to location.

The emerging concepts of water governance and social learning suggest further key challenges for capacity-building.

Whilst much has already been learnt from field experiences, there will always be a need for further learning as the needs for capacity-building change in the constantly evolving context of PIM.

VII. SALIENT HIGHLIGHTS OF THE PAPERS ON THE THEME “SUPPORT SYSTEM FOR SUSTAINABLE PIM”

INSTITUTIONAL ASPECTS, CONSTRAINTS, AND OPPORTUNITIES

GENERAL REVIEW

7.1. There are a number of evidences suggest that sustenance of institutional gains over a long run is often debate-able especially under the poor institutional conditions with the short-lived project activities.

7.2. In fact, the continuation of external support should be continuously provided for a period of time before the capability of the community to manage the project on self sustainable basis – among others are: (1) supporting policies and strategies; (2) capacity building, training, and extension; and (3) monitoring and evaluation.

INSTITUTIONAL ARRANGEMENT

7.3. From the perspective of institutional arrangement, there are at least three significant and complementing actors: national/provincial governments, irrigation agencies and/or water users associations, and the irrigators. The institutional linkages among the three governance levels of responsible actors are evident.

7.4. Despite that the refine Goals and Objectives of PIM, however, for last several years, clear and measurable objectives are not yet laid out. In Nepal for instance, transferring the irrigation system over to WUAs in itself is perceived as one of the objectives in contrast to defining the impacts and results that are expected from the management transfer. For example, experience in Nepal greater farmer participation in water supply and system management; increased contribution of farmers' resources to operate and maintain the systems; higher production; and a more positive farmer perception towards water delivery services. The main threat, however, is the lack of sustainability.

SUSTAINING THE POSITIVE ACHIEVEMENTS

7.5. To ensure a sustainable positive impact, the state needs to give much more attention towards issues such as: (1) Sufficient resource allocation for O&M (be it from farmer contributions or government subsidies); (2) Ways to locate good leadership in the community and create an enabling environment for its emergence; (3) Focus on institutional development of WUA before rehabilitation, as preconditions before starting technical works; (4) Post transfer support: DOI should broaden its role of 'irrigation system manager' towards 'support service provider'; and More (human and financial) resources allocated to ensure a functional monitoring and evaluation (M&E) system to monitor impacts of PIM/IMT.

OPPORTUNITY FOR EFFECTIVE INSTITUTIONAL ENHANCEMENT

7.6. Planners need to consult with water users about what support services are most needed by the farming community in order to assume the new responsibilities and tasks as well to overcome constraints.

7.7. Support services during and after management transfer may include advisory services about institutional arrangements, establishment of organizational and financial procedures and skills, credit facilities, legal advice, marketing and construction procedures.

7.8. Training and extension are amongst the most important tool to develop the knowledge and skills of farmers and enable WUA officials to undertake management responsibilities and to ensure more profitable irrigated agriculture.

FARMERS NETWORK FOR WATER SECTOR REFORMS IN SOUTH INDIA

7.9. The farmer's network is the pre requisite for the success of PIM that warrants devolution of power from department to water users. In this context the FNWSR in India not only enables negotiate and contest with the government agency but also facilitate building consensus and cooperation from fellow farmers.

7.10. It is evident from the evaluation that the FNWSR has created considerable impact on PIM through creating awareness among farmers, direct interaction with the policy makers, facilitating implementation process, with limited financial resources.

FORMULATION OF COMMUNITY DEVELOPMENT PLAN IN SEMI-ARID ZONE

7.11. The *khettara* (system resembles tertiary canal of a large irrigation system in end water distribution system in Morocco) system has been well operated for several hundreds years because community itself was established on the basis of *khettara* water.

7.12. With assistance of local governments considering the major significance of the *khettara* rehabilitation, i.e., (1) less cost and safer water sources; (2) sole water source for stable agricultural production; (3) source to preserve social system; and (4) heritage for the future.

7.13. In the light of these facts, it is expected in Morocco that the Government will continuously support communities and unify them into more large organization such as "communal society" to stabilize and increase farm income of the rural communities under their initiatives.

CONCEPTS AND ANALYSIS OF PUBLIC PARTICIPATION

COOPERATIVE MODE OF PUBLIC PARTICIPATION

7.14. One of the effective ways in water resource development is through public participation such as on public in scheduling, construction, completion and maintaining the projects. In East Azerbaijan, for instance, the participation of the public in completion and maintenance has been initiated through cooperative approach referred to as Water Supplying Cooperative Companies (WSCC).

7.15. Through the WSCC, public participation has been implemented by means of socio-economic and management to benefit from the water resource projects. Through the close interaction with the authorities within the framework of the WSCC, the effective life of the projects has been increased and a better use of soil and water resources. The case of East Azerbaijan is considered as a successful model for public participation.

PERFORMANCE STUDY OF PARTICIPATORY IRRIGATION MANAGEMENT

7.16. A study observation in Orissa State, India concludes that the Pani Panchayat as regulatory institutions in charge of water distribution on equitable basis, their performance has been reasonably weak and unsuccessful. Even though Pani Panchayat has been initiated and endorsed in the State for more than a couple of years, the acceptance of the model have been lethargic and scattered. However, the study showed that co-operation increases with increase in farm size.

7.17. Researchers have drawn up a strategy for policy makers to ensure IMT programs become more pro-poor stressing the need to clearly define the rights of farmers, raise awareness of these rights, reform the election process, and monitor participation in water user authorities.

7.18. A detailed action plan should be prepared in consultation with the water users through Participatory Rural Appraisal (PRA) method. It is necessary to apply bottom-up approach instead of top-down for sustainability. Simpler procedures are needed that still provide the WUA organisations with sufficient legal standing to deal with government agencies, contract with private firms, contractors, and control resources within the group.

PERFORMANCE EVALUATION OF NEW IRRIGATION PROJECTS IN ZANJAN PROVINCE, IRAN

7.19. For new irrigation project, the most important aspect to put into effect is that the implementation has to be based on appropriate programming as well as performing of irrigation designs and projects implementation.

7.20. An evaluation study has been conducted in Zanjan Province, Iran concludes that the performance of new irrigation projects have been ranked into four levels including excellent, good, moderate and weak. The overall evaluation of projects in zanjan indicates that the weakness from the qualitative analyses, while the evaluation indicate the good performance from qualitative.

7.21. From these projects, three successful contribution projects have been identified, however, the performance evaluations from pressured irrigation in third program in Zanjan Province, the study concluded that these projects aren't conformities in contribution degree from quality point.

7.22. From performance evaluation, some recommendation for future implementations are as follows: (1) The projects have to be equipped with data base networks from national water sources with appropriate quantity and quality as well as time accuracy; (2) Water measurement networks must be effective to support appropriate water resources allocation; (3) Improvement of irrigation efficiency and water utilization is most important aspect to consider; (4) Implementation of artificial feeding projects by groundwater during the non culture seasons; (5) consistent assistance to water users association for improving operation and maintenance; (6) The result from studies about comparing evaluation of pressured irrigation and difference in irrigation efficiency, it is potential in pressure way to use more lands from irrigated farms.

FARMERS' PARTICIPATION IN IRRIGATION WATER MANAGEMENT IN NORTHEAST IRAN

7.23. A study has been implemented in Northeast Iran to investigate the farmers' participation in irrigation networks found that Water User's Community (WUCs) as the considerable social capital can improve the level of farmers' participation in irrigation water management.;

7.24. Significant differences was statistically found between two groups of WUs, those who involved in irrigation network with WUC and those in non-WUA networks in relation to the individual variables of age, education level, and experience in agriculture.

7.25. Significant differences were found between two groups of respondents from the stand point of all their cultural and social characteristics, namely extension contacts, communication channels, social confidence, social solidarity, social participation, farmers' attitude toward the WUC, and farmers' participation status concerning irrigation networks management.

7.26. The analysis results indicated that among technical factors, there was a significant difference between farmers' behavior regarding farm water management and farmers' perception of rural irrigation status in two groups of respondents. Hence, agricultural policies in Iran must aim at raising the potential of water management technologies through the development of multi-functional WUCs to enhance agricultural water productivity, promote equitable access to water and to conserve the natural resource.

PARTICIPATORY MANAGEMENT OF MODERN IRRIGATION SCHEMES IN IRAN

7.27. A study of stakeholder views on the modern Dez and Moghan irrigation schemes has suggested farmers and extension staffs that the existing canal management is not sufficiently responsive to the new challenges of agriculture in the post-reform era, and that a more participatory approach could help resolve the problems in water delivery.

7.28. Iran already has a long-standing and successful model for participatory farmer management in the millennia-old Miraab system (*Shaarebin*) used for managing the Karezes and Qanats in the arid and semi-arid regions of Iran. The survey responses indicated that all three stakeholder groups (farmers, extension staffs and water agency staff) would support the implementation of a management structure based on the Miraab system.

7.29. It is suggested that farmer organizations should take the government's interest in irrigation management transfer as a window of opportunity to take up the stewardship of, initially, the tertiary water distribution system. They should use their indigenous knowledge to achieve the flexible demand management required for viable modern farming.

7.30. The commitment of farmers and support of other stakeholders are both crucial for success of the Miraab systems in the new working context. Successful management of the tertiary canals would be a good start for the ultimate establishment of the full farmers' stewardship of the main and secondary canals in the future.

PIM OPTION FOR GROUNDWATER

7.31. A study has been conducted to study analyzes the situation of groundwater resource use in the Abshar irrigation system in the Zayandeh Rud Basin, Iran and establishes the question if participatory management of groundwater and conjunctive use is a viable option for irrigation management in the present context.

7.32. The remaining questions to be established among others: "Is participatory groundwater management within and outside of surface water irrigation systems a feasible solution?" If so, what knowledge is needed? What social structures are needed and at what scale? How should responsibilities be established and who should be responsible for what? What role should be delegated to the state? What role should be delegated to the water management agencies? What responsibilities should go to user organizations and how do you organize these? Is there a need for institutional engineering?

PARTICIPATORY IRRIGATION MANAGEMENT IN IRRIGATION NETWORKS OF TEHRAN PROVINCE

7.33. The PIM concept in the section of irrigation and agriculture in the wide land of Iran with water scarcity has a long history. After the victory of Islamic revolution of Iran government provided a fast development in water industry in the demand of work.

7.34. The process of participatory management shift has been done either by voluntarily establishment of people or it has been done by the application of government, so they have been able to use this design through actual field performance.

7.35. Learning from experiences in Teheran Province, there are a number of problems and constraints associated with PIM implementation. These are among-others: (1) limitation of authorities and legal instrument as well as support system; (2) Unclear water right (3) Diversified water policies causing problems on the management shift in the cities of Tehran Province; (4) Lack of successful PIM model the purpose of attracting people participation; (5) Lack of sense of ownership and responsibility in PIM implementation; (6) Lack of inter-sectoral coordination; (7) Highly dependence on the government on the water services; (8) Problem of land conversion from irrigated agricultural lands to industrial, housing and other non agricultural purposes; (9) Lack of initiative for proper maintenance of irrigation infrastructures; (10) Lack of public awareness on the appropriate use of safety facilities provided for irrigation infrastructures.

APPLICATION OF PROPORTIONAL PLUS RESET (P+PR) AUTOMATIC CONTROL SYSTEM FOR PARTICIPATION OF WATER USERS IN DELIVERY MANAGEMENT

7.36. Due to low performance of irrigation networks improvement, water delivery systems and its performance, within in recent decades several automatic control Systems including P+PR system, for flow management in irrigation networks have been introduced. Applications of these techniques provide situation that, water users play a direct role in water delivery with high flexibility.

7.37. To test the performance control in this study, the ICSS hydrodynamic model has been applied on ASCE standard canal number two to test the global performance of P+PR downstream automatic control system, having a conclusion that application of this control system in irrigation canal which provide higher flexibility and direct participation of water users in management of water delivery could be suggested.

7.38. The study concludes that the performance of developed P+PR automatic downstream control system for simultaneous and significant diversion variations of outlets is quite suitable and it could be used as an effective instrument for direct participation of water users in management of water delivery.

PARTICIPATORY IRRIGATION MANAGEMENT IN MAHARASHTRA STATE, INDIA

7.39. Over the last 10-15 years, there was appreciable growth in WUAs by the Government of Maharashtra (GoM), India. There are number of success stories, underlining the importance of WUAs. On the other hand, there are also some instances of no appreciable improvement in performance of irrigation projects with WUAs.

7.40. The study observes that Irrigation management transfer improves the service delivery as well as financial performance of the Project. There is need to have committed support from WRD and timely efforts to build WUAs to shoulder the responsibility. The Maharashtra case study provides insight into important aspects of PIM and possible measures to strengthen WUAs movement.

7.41. Though Maharashtra approach to PIM is gradual, but with reforms in place and changed mindset of officers of WRD and farmers, PIM could lead to sustainable irrigation management.

PARTICIPATION OF THE FARMERS ON O&M OF IRRIGATION NETWORKS IN CENTRAL JAVA AND WEST NUSA TENGGARA PROVINCES, INDONESIA

7.42. Under the new law on Water Resources No. 7/2004 and the Government Regulation on irrigation No. 20/2006 in Indonesia, the central and local governments recognize the role of the water user associations (WUAs) to carry out the irrigation networks system management based on farmers' participation approach.

7.43. This research gives general responses of the farmers' participation at the planning and performing processes respectively as indicating the scores of 2.77 and 2.80 and classifying the moderate categories as well as at the evaluating process as indicating the score of 3.2 and classifying the high category.

7.44. The farmers' responses on operation and maintenance of the irrigation networks system management in two provinces summarizes that 42% of farmers is categorized as high participation, 16% as moderate participation, 32% as low participation and 10% as very low participation.

7.45. Several other researches have been carried out for different locations in Indonesia suggested that there is a positive correlation between the farmers' participation and the performance of O&M of the irrigation networks system in Indonesia.

FORMATION AND DEVELOPMENT PROCESS OF PIM IN QAZVIN AREA, IRAN

7.46. Since the last fifty years, gradual progression in management style of irrigation and drainage systems supported by promotion of people's participation in management trend has faced the government-oriented or hindering mechanisms to critical challenges at global scale.

7.47. A holistic plan for capacity building and empowerment of local farmers was founded in the province to develop a participatory management and promote due changes towards optimum utilization and maintenance of the network. The initiative is reliant on a tree-shaped model and consists of: farming groups, water users associations, unions and their apex Federation at provincial level.

7.48. Presently, many commitments encompassing structural rehabilitation and water distribution have been shifted to the farmers in Qazvin, followed by logistic and administrative works handled by private sectors. Dynamic involvement of the young generation (men and women) at managerial and technical levels scattered at WUAs branches or Federation posts remarks for outstanding aspects of the PIM system in Qazvin.

7.49. To date, the mode applied for creation of CBOs (community-based organizations) and legislation of NGOs in terms of Water Users Association (WUAs) in Qazvin, generates a national pattern over the state.

RESEARCH PROJECT FOR IMPROVEMENT OF PIM (THE TAFILALET AREA, SOUTH-EAST OF MOROCCO

7.50. The research project for improvement of PIM is a concrete follow-up of the Rural Development Project in the Tafilalet (PDRT). The Tafilalet is located South-east of Morocco, in the pre Saharan, south-of the Atlas mountains zone to make it possible for users to upgrade their intrinsic capacities through: (i) organizing themselves within Water Users Associations (WUAs) where water resources are available; and (ii) meeting O&M costs incurred by irrigation systems.

7.51. During the four years of project implementation by introducing new methodology and a new approach to prompt farmers to contribute to ensuring durability of irrigation infrastructure, the project has been able to reach almost all of the goals set down: (i) organizing and training farmers within the context of their WUAs; (ii) enhancing awareness by means of training courses and field trips; (iii) promoting water-saving irrigation strategies through practical demonstration plots and acquisition of logistics support; and (iv) setting up a database for follow-up evaluation of the WUAs' performance.

PRDA: A PARTICIPATORY METHODOLOGY FOR ANALYZING AND IMPROVING IRRIGATION PERFORMANCE – CONCEPTUALIZATION AND EXAMPLE OF APPLICATION IN KENYA

7.52. The APPIA (is a French acronym for "Improving Irrigation Performance in Africa") project is implemented in several countries in Sub-Saharan Africa. One of the major activities of the project was to develop and test in the field a participatory methodology for analysing and improving the performance of farmer-managed irrigation scheme. This methodology has been named PRDA for "Participatory Rapid Analysis and Action Planning of Irrigated Agricultural Systems". A manual published by IWMI and the FAO presents the details of the methodology.

7.53. Based on the results obtained during the course of the APPIA project in Kenya, it is suggested that PRDA may be one tool to achieve successful participatory irrigation management that can be used by multi-disciplinary/multi purpose organization such as National Irrigation and Drainage Committees.

7.54. Technicians and policy makers realized that there was no organization in country that can address all issues related to irrigation management. Hence the Ministry of Water and Irrigation decided the formation of a professional association to enhance networking amongst irrigation players, implement multi-disciplinary approaches and develop further Research & Development programs.

SUSTAINABILITY OF PIM

MEASURING OF SUSTAINABILITY

7.55. Given special scrutiny of the themes on international experience with measuring performance of WUAs; common pitfalls for sustainability of WUAs; and main technical and institutional indicators for measuring WUA performance, it has been concluded that the institutional arrangements for M&E of WUA performance, such as Federations of WUAs, the role of national, regional and local authorities in measuring WUA performance and the maturing of PIM as a process of development.

7.56. This conclusion puts forward a hands-on approach for policy makers, implementation experts, academics and consultants for ensuring and improving the sustainability of PIM.

STRATEGY FOR PIM SUSTAINABILITY

7.57. Considering the competition in consumption of agricultural water and optimum use of accessible water resources, a study for creating participative irrigation management has been conducted in Foumanat Irrigation Network (Gilan Province) and Soufichai Irrigation Network (East Azerbaijan Province).

7.58. The study concludes that the strategy for PIM sustainability must be perceived that operation and maintenance of irrigation networks is not independent from ways of participation in rural and urban societies.

7.59. The ways and degree of participation in irrigation networks have to be seen from two major considerations: The first that the degree of willingness of the mother exploiting company to assigning part of its responsibilities and the second is the users who are going to accept the responsibility.

7.60. For enable the effective allocation and distribution of water in irrigation networks, the operator must be equipped with analysis instruments, which has to be able to demonstrate water allocation to each system that would resolve the competitive use of water amongst the users.

MICRO-PLANNING IN PIM, AN ENTRY POINT FOR SUSTAINABILITY

7.61. In India during 1990s systematic institutional and organizational changes have been undertaken to increase farmers' participation in irrigation management through formation of Water Users' Association (WUA) or Pani Panchayats under different externally assisted economic restructuring and irrigation infrastructure development programmes of World Bank, European Commission, Japan Bank for International Cooperation.

7.62. Today, Participatory Irrigation Management (PIM) at various levels is being implemented in different types of irrigation systems. For this program, appropriate institutional arrangements and mechanisms to bring about efficient utilization, equitable distribution and sustainable irrigation service are framed by different states of India.

7.63. From a number of experiences learned in Orissa, the poorest state in the dominion of republic of India, concludes that the strategic micro level planning along with identified entry point implementation program that are undertaken for sustainable irrigated agriculture simultaneously.

7.64. The study concludes that the objective of poverty reduction by way of promoting schemes for agricultural productivity can be achieved by adopting community based participatory approaches that support agricultural development like improving irrigation performance. These could be achieved by employing new production technologies, enhancing access to markets, promoting environmentally sustainable production activities, having gender perspective, measures to improve income and livelihood through micro-finance, rural infrastructure up-gradation, and participatory processes to empower the rural poor.

THE NECESSITY OF FARMERS PARTICIPATION IN PRESSURIZED IRRIGATION SYSTEMS FOR PIM SUSTAINABILITY IN IRAN

7.65. As a developing country, Iran has several large-scale irrigation and drainage networks under study and operation. These networks are often constructed in small-scale farmlands, and because of water deficit, inappropriate topography and incentive policies, they are equipped with pressurized irrigation systems in which operation is more complicated, comparing with surface irrigation method.

7.66. Based on a study results obtained from performing under pressurized irrigation systems by government is compared with the one constructed by farmers organization, offers some suggestions with regard to changing the present procedures and participating farmers organizations in project execution.

7.67. The study observation conclude that the pressurized irrigation projects in large areas which are constructed in small scale farmlands, all of the project execution are done by government and after accomplishment of project execution, will be transferred to farmers organizations.

7.68. However, this approach will result in farmers' irresponsibility, and it will, in turn cause their dissociation during project operation so that after transferring the system to farmers' organizations, farmers will ascribe the organizations' managers to be responsible for all the system's problems.

SUSTAINABLE PARTICIPATORY IRRIGATION MANAGEMENT

7.69. To make proper decision on irrigation management transposition, "sustainability in irrigation management" and specifically PIM, which is the result of transposition program should be taken into consideration.

7.70. In irrigation management transposition process, the persistence of activities in the form of new operational system, which is the subject of sustainable management, is focal point of the transposition program.

7.71. The main elements in the sustainable participatory irrigation management are: (1) Strategies; (2) Training and Extension; (3) Monitoring and valuation.

7.72. In all the three abovementioned main elements, it is recommended that the rational advisory models to be substituted for the common governmental trends, which requires: (1) In policymaking, new guidelines with no consideration for administrative caution, but correspond to requirements of local developing society to be submitted; (2) In training and extension, in addition to formal education in agricultural and irrigation activities, the issues relevant to reconciliation of technical specifications of the network with social requirements of an operation unit to be clarified for the stakeholders; (3) By the assistance of a specialized support system.

EVALUATION OF IRRIGATION PERFORMANCE

PERFORMANCE EVALUATION OF NEW IRRIGATION PROJECTS (ZANJAN PROVINCE, IRAN)

7.73. In an attempt to evaluate the water efficiency in agriculture it's necessary to focus our best tries on programming and performing irrigation designs and projects.

7.74. Regarding to performed evaluations from pressured irrigation in third program in Zanjan Province, Iran, it was realized that these projects aren't conformities in contribution degree from quality point.

7.75. Learning from experience of the project implementation, the following aspects are recommended: (1) Water resources data base must be provided accurately from quantity and quality aspects; (2) Water measurement networks installation must be improved to ensure better irrigation management; (3) The increase of irrigation efficiency could be achieved by appropriate irrigation water operation; (5) On pressured irrigation it's necessary in pressure way to use more lands from irrigated farms.

IMPACTS OF SOCIO-ECONOMIC DEVELOPMENT

IMPLEMENTING PIM MANAGEMENT IN THE LITERATE STATE OF INDIA

7.76. Kerala, elongated coastal state of India, lags behind many states in the country in participating farmers in the management of irrigation, and implementing PIM.

7.77. Fragmentation and subdivision of land and resultant small size of holdings (average 0.3 ha); part-time cultivation of farmers who are literate (literacy rate 91%); lack of sufficient labor availability and high labor cost; and lack of coordination among various departments are the major threats to irrigated agriculture in Kerala.

7.78. PIM pilot projects being implemented at Neyyar and Malampuzha Irrigation Projects of the State have shown that, farmers are highly motivated and are ready to share responsibilities of PIM. Since spouses of farmers are also inducted as members of WUAs, enthusiasm shown by women in managing irrigation is encouraging.

7.79. The pilot project experiences are also encouraging. But the hesitation of officials to depart from the existing system, the reluctance of operational staff to involve users in management, and lack of legislative backing, are the main blocks noted.

7.80. The observation concludes that there are several problems that may hinder the implementation of PIM in Kerala, as mentioned above. But prospects are not too bad, as there are several contributing factors. If the irrigation agency supports and nourishes, PIM will nourish in Kerala also.

7.81. It is expected that the lessons learnt from the pilot projects on PIM may help to gear up the political and administrative will to counter this.

PARTICIPATORY EXPERIENCES FOR ENHANCING LAND AND WATER PRODUCTIVITY

7.82. This paper shares the experiences of a project having measures to facilitate the formation of land and water management strategies and institutions that are socially acceptable and broadly replicable. The paper describes the participatory process developed and adopted for exploring options for better use of water with focus on a single distributary of Patna Main Canal system through cost effective participatory mechanism, involving poor farmers, landless and share croppers.

7.83. The observation concludes that peoples' participation has been identified as one of the major principles for sustainable development of water resources. This reflects to believe that people who inhabit an environment over time are more competent to make decisions. Establishing dialogue amongst these stakeholders needs identification of appropriate processes and means through which they can be brought together for a common goal.

7.84. The experiences in collaborative project and wide range of project partnership reflects that participation with community members on land and water related issues is mainly focused on two general types of situations: (a) set of issues focusing immediate and critical concerns leading to short-term emergencies or gains such as; irrigation needs, eradication of seasonal water logging and falling crop yields and (b) concerns that provide opportunities to different stakeholders to come together for longer-term, precautionary issues. To achieve these goals the perspective should be broader which may accommodate members from wider constituency.

IMPACTS OF FARMERS' NGOS ON SOCIO-ECONOMIC DEVELOPMENT OF QAZVIN AREA, IRAN

7.85. It is commonly understood that inefficient management in O&M of irrigation system is assumed as a key element in weakening irrigation performance. Based on experiences, removal of existing inconsistencies and challenges will not realize without people's participation.

7.86. The analysis in this article have been made to formulate and implement a strategic plan for establishment and operation of NGOs (Non-Governmental Organizations) in

Qazvin plain mobilized by face to face communication towards further involvement of his staff (Qazvin Irrigation Management, QIM) and target farmers in the process.

7.87. Based on a timing schedule, an action plan became operational to gradually shift exploitation and maintenance of existing irrigation-drainage network to the local community. Various commitments e.g., selling, inspection, registration, distribution and delivering water quotas are to be implemented by corporate WUAs.

7.88. Implementation of IMT (Irrigation Management transfer) initiative in Qazvin, Iran has resulted in numerous cultural, social and economic impacts especially in the area of improvement of irrigation management and has created structural changes towards the great objective i.e. "Equitable distribution of water" in the network.

PIM, POVERTY AND MODERNIZATION OF FARMER'S ORGANIZATION (FO) MANAGED IRRIGATION CHANNELS IN SINDH, PAKISTAN

7.89. The concern of this paper is to assess the role of FOs in managing and implementing the investment and modernization schemes of their own managed channels under PIM in Sindh province of Pakistan. The paper seeks the contribution of PIM modernization intervention in reducing the poverty, equity in delivery of water service and sustainability of FOs. The paper then focuses on the current PIM concepts, reform, and its process. The paper also address the issues of rehabilitation works, contract management.

7.90. The overall analyses concluded that PIM has evolved and become generally accepted as a necessary aspect of productive and sustainable irrigation. The schemes of modernization of irrigation channels are an excellent opportunity to address the issues of sustainability of FOs, sustainable water resource management. The FO managed investment schemes have not only addressed the local employment issues of landless agriculture and rural worker but also has addressed the water equity and efficiency.

7.91. The increased farm productivity and income has reduced poverty from the rural poor. In Sindh PIM has proved to be successful model. But it is long way to go and government still needs to support and create support services for sustainability of reforms in Sindh. An empowerment model has to be followed and enabling environment for these new institutions has to be created.

7.92. There is a need to maintain the transparency and create support service for institutions created under reforms, particularly FOs and water management agency.

VOLUMETRIC PRICING OF IRRIGATION WATER IN INDIA: EXPERIENCES AND LESSONS LEARNED

7.86. Volumetric method of pricing irrigation water has always been advocated as the better approach to induce water savings by farmers. However, owing to seemingly technical and administrative complexities in adoption of the volumetric method, the area based pricing method is widespread in most countries.

7.93. In India, during the last decade, there has been significant development in adoption of the volumetric supply and pricing through PIM. A case study of volumetric allocation, supply and pricing adopted by a WUA in the State of Maharashtra has been presented.

7.94. The experiences and lessons learned from the case study and similar other WUAs have clearly demonstrated that a combination of volumetric supply and pricing at the entry point of a WUA command area and subsequent distribution and recovery on crop-area-season basis by the WUA can become successful.

7.95. The concept of volumetric supply can gradually be introduced at individual farmer's level by roping in available technology and farmers' involvement. There is a particular need to strengthen the role of WUAs to equip them for the enhanced responsibilities which calls for a major capacity building exercise.

7.96. The Way Forward: (a) Volumetric supply and pricing of irrigation water in India is still at experimental stage and has to go a long way before it becomes a widely accepted and an integral component of WUA's operation; (b) The case study has amply demonstrated that farmers are willing to pay higher water charges provided the supplies are reliable, flexible, equitable and there is a transparency in the billing system; (c) There is a need to make the flow measurements more accurate, reliable and the structures more robust. The flow measuring device may be equipped with an automatic water level recorder to account for fluctuating flow rates and convert those into volumes; (d) Deficiencies in the construction and maintenance of the measuring structures need to be removed. Some innovative flow measuring devices may be tried. There is a need to provide water level regulating structures in the canal network to maintain stable flows at the measuring points.

CAPACITY BUILDING

PARTICIPATORY TRAINING PROGRAM, IN ANDHRA PRADESH, INDIA

7.97. This paper deals on the field activity of participatory training program (PTP)/capacity building of various stakeholders undertaken by Jala Spandana in large canal irrigation projects in Andhra Pradesh, India. Given the objectives as to strengthen PIM, sustain WUAs, enhance water use efficiency and livelihoods, the JalaSpandana Designed Participatory Training Programme (PTP), exploring alternates for efficient main system management, sustainable WUAs, tail end deprivation.

7.98. The trainings were carried out in an integrated approach to Integrated Water Resources Management (IWRM) with unlimited time bound program that is easy to encompass all the complexities of the irrigation system, which again could be registered by the participants.

7.99. Under the support of the Government of Andhra Pradesh. PTP has been extended to irrigation projects that are undergoing modernization program with huge expenditure. The representatives who were initially discussing only on physical works started exploring alternatives for efficient water management.

7.100. Lessons Learnt: PTP is the right way of training program as different stake holders realize their roles and responsibilities and in three years period, the project committee of WUAs or Department officials show the sign of taking over the training as part of water management. The department officials and WUAs prove great potential to resolve majority of the issues including tail enders and operation and maintenance issue.

7.101. The **time** frame for PTP in these large irrigation projects given the magnanimity of the issues and work in large irrigation project **is inadequate**, the field experience shows that at least three years is necessary for NGOs to prepare the ground fully and **exit**.

7.102. The intensified PTP in large irrigation projects compounded with policy reforms certainly make PIM success in AP, particularly in the wake of policy making WUAs continuous body with every two years election to one third of the members. It would be appropriate for INPIM to support activities like Farmers Network for Water Sector Reforms and Develop PTP.

BUILDING CAPACITY FOR PIM - EXPERIENCES AND EMERGING ISSUES

7.103. This paper builds on established concepts of capacity-building to look in turn at the key dimensions of the policy environment, institutional strengthening and individual development. A range of approaches to institutional strengthening are put forward.

7.104. The paper then goes on to discuss water governance and social learning, as two key emerging issues of particular relevance to capacity-building for PIM. Water governance provides a framework for viewing PIM within the wider perspective of the water sector as a whole, while the current emphasis on social learning is particular relevant to concepts of participation and PIM, and provides an entry point for capacity-building through individual development.

7.105. Recent experiences collated through ICID workshops and elsewhere are reviewed for insights into capacity-building for PIM. These include experiences from India, China, Peru, and transition economies such as Ukraine and Albania, with reflective case studies from Pakistan, Bangladesh, Nigeria and Tanzania. The paper draws on these experiences to develop some general conclusions in the light of the theory and concepts of capacity-building.

7.106. The general conclusion is that the Institutional strengthening provides the most significant issues in capacity-building, and there is no blueprint for success. The emerging concepts of water governance and social learning suggest further key challenges for capacity-building. Whilst much has already been learnt from field experiences, there will always be a need for further learning as the needs for capacity-building change in the constantly evolving context of PIM.

PIM, POVERTY AND MODERNIZATION OF FO MANAGED IRRIGATION CHANNELS IN SINDH- PAKISTAN

Nazeer Ahmed Memon[1]

ABSTRACT

The concern of this paper is to assess the role of FOs in managing and implementing the investment and modernization schemes of their own managed channels under Participatory Irrigation Management in Sindh province of Pakistan. The paper would also seek the contribution of PIM modernization intervention in reducing the poverty, equity in delivery of water service and sustainability of FOs. The paper will focus on the current PIM concepts, reform, and its process. The paper will address the issues of rehabilitation works, contract management. At present at least 180 irrigation channels have been transferred to FOs for management and operation followed by assessment and collection of water service charges. The FOs have also been given an opportunity to implement and undertake the rehabilitation and modernization schemes for improving channels maintenance and operation.

1. INTRODUCTION

Under the water and poverty initiative (WPI) there has been many papers presented by various forums including Global Water Management (GWP). These initiatives have been instigated by the major donors under the co-ordination of the Asian Development Bank. In recent years there has been an increased focus on reducing poverty as a key responsibility of government and objective of donor support. This was reinforced at the UN Millennium General Assembly when the Millennium Development Goal of halving the proportion of the world's population living in extreme poverty by 2015 was agreed by all member countries of the United Nations. Other goals and targets specific to water and poverty were agreed at the Millennium Assembly and at the World Summit on Sustainable Development.

At present about 68% pf Pakistan’s population living in rural areas is directly or indirectly linked with agriculture for their livelihood. The poverty assessment indicates that about one-third of the Pakistan population is poor, and two-thirds are found in rural areas. Poverty in rural Pakistan is deeper and more severe than in urban areas. The low

1- Social Development Specialist, Sindh Irrigation and Drainage Authority (SIDA), Left Bank Barrage Colony, Hyderabad Sindh- Pakistan. Email: nzessani@hotmail.com, Phone: +92 22 921 0085, Fax: + 92 22 921 0081

agricultural productivity has been reported a major cause for poverty. The agriculture productivity depends importantly on the availability of water for irrigation.

The paper is to review the overall status of reform and poverty in Sindh. With the passage of time it has been witnessed that the PIM and water-related services can help reduce poverty in the contexts of public health, land use, food production, livelihoods, agricultural development, rural planning and environmental protection. Based on such presumption, the PIM has been recognized as main tool in poverty reduction, especially in the countries where agriculture is a key mean for livelihood.

2. DEFINING PIM: PROCESS AND APPROACH

Participation is a process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them. Participatory Irrigation Management refers to the involvement of farmers/irrigation users in all aspects of irrigation management. The intensity of participatory management may range from minimal user involvement to the transfer of nearly all management functions. There are various aspects of PIM that include planning, design, construction, operation & maintenance, financing and policy matters. Similarly PIM can be implemented at various levels i.e. quaternary, tertiary, secondary, main system, project and sectors.

3. WATER MANAGEMENT NET WORK OF SINDH

Sindh province has almost 13 million acres of irrigated lands in its three barrage command areas, built between 1932 and 1962. Sukkur barrage was the major irrigation achievement with a command area of 7.6 million acres. The barrage was built at a strategic location, some 600 kilometres upstream from the deltaic regions in the Arabian Sea. The other two barrages in the province are the Kotri barrage (with CCA 3 million acres) and the Guddu barrage (2.1 million acres) , built in 1955 and 1962, respectively, with the former being upstream from the Sukkur barrage and the latter being roughly 150 kilometres away from the coastal and deltaic communities. The irrigation system of Sindh province has total gross command area (GCA) of 14.391 million acres (5.8 million hectares), out of which 3.211 million acres is classified as cultivable waste, which can be brought under cultivation if irrigation water is available. In 1999 the total waterlogged area was calculated as 5.434 million acres which appears to be more than 30% of the total command area of the province.

The irrigation system of the province below the barrages comprises 14 feeders and main canals, 1462 branch canals, distributaries and minors. More than 95% of the irrigation is from canal water. The water withdrawal capacity of the barrages totals as 125,625 cusecs (designed) and 150,931 cusecs (maximum). The controlled irrigation system installed during the colonial years was a vast network of waterways that carried irrigation supplies from the river source to the farmlands. The system runs 13234 miles in form of main canals, branch canals, distributor canals and minor canals. The main canal draw water from rivers at the barrage points and delivers water into the branch canals. Water reaches the farm through distributaries or minor canals, which take water from the branch canal, the lower middle tier of the irrigation system. Around 78% of the area in Sindh province is underlain by saline groundwater, which is unsuitable for irrigation. Close to the edges of the irrigated lands, fresh groundwater can be found. Refer below the map of irrigation system of Sindh:

A part from irrigation system, Sindh has drainage system which as such is not contiguous and integrated. There are 13 existing surface drainage systems in Sindh, which serve a total area of over 6.2 Million acres (2.5 M ha) and have an aggregate length of about 2,981 miles (4,800 Km). In addition there are two sub-surface drainage systems, which serve an area of 0.10 Million acres (0.04 M ha).

4. MAGNITUDE OF CRISIS

It is estimated, however, that out of the 13 million acres comprising the greater canal area in the province, at least one million acres-mostly owned by small and poor land-owning families- do not receive sufficient irrigation supplies. The situation is extremely distressing to the communities or settlements that are dependent on the surface irrigation flows for drinking and other domestic uses. The Sindh Government's annual expenditure on O&M is more than 3000 million rupees against its annual revenue (water charges) of less than 1000 million rupees. An example of financial year 2001-02 is given in below. As stated earlier, the Sindh Irrigation System is part of the Indus Basin irrigation system, the world's largest irrigation system. The size of the system is enormous by any standard. The area in the Province irrigated by the fourteen main canals from the three barrages on the Indus River is 5.5 M ha. To give a measure of the size of the irrigated system in the Province of Sindh: it is twice the irrigated area in Mexico and almost equal to the area under irrigation in Egypt. The movements towards participatory irrigation management in Sindh has its background in problems encountered in irrigation systems elsewhere – though probably in an amplified form: the inability to subsidize irrigation and drainage operations with public resources, the difficulty to maintain performance standards and the increased unwillingness of water users to contribute in cash or in kind. The irrigation system of Pakistan is the largest irrigation system in the world. Its construction was begun long before partition and it was expanded after independence. In Sindh alone, the system has 3 barrages and over 20, 000 km of larger and smaller canals. Today the system is in danger since there is not enough money to maintain and operate the system.

5. THE STATE OF PIM AND POVERTY IN SINDH

Sindh has a total population of over 30 million, majority of which (51%) lives in rural areas. The total geographical area is 14 million ha, constituting 17.5 percent of Pakistan. About 5.8 million ha is commanded by canals. Net area sown is about 3 million ha, with about 1 million ha sown twice a year.

It is estimated, that out of the 13 million acres comprising the greater canal area in the Sindh province, at least one million acres-mostly owned by small and poor land-owning families- do not receive sufficient irrigation supplies. The situation is extremely distressing to the communities or settlements that are dependent on the surface irrigation flows for drinking and other domestic uses.

The Sindh Government's annual expenditure on O&M is more than 4000 million rupees against its annual revenue (water charges) of approximately 600 million rupees. The irrigation and drainage system has its institutional weaknesses in terms of management. The continuous centralized management has deteriorated the water management system in Sindh and as a result of that system's efficiency has reduced miserably to 30% only. The environmental issues caused due to inefficient management have never been looked into which resulted in destruction of wetlands, Indus delta and marine life, poor water quality, sea intrusion and disappearance of fresh water in the down stream part of Indus River. The waterlogging and salinity has affected more than 40% of the total cultivable command area of Sindh.

The poor water management service directly affects socio-economic condition of the people of Sindh province especially rural people who have direct stake in water-the main source of their livelihood. The index of Poverty in rural Sindh is deep and alarming. About 37% population lives below the poverty line compared to 33% in Pakistan on an overall basis. Over 70% of the rural population is landless. Rural households, including the landless, derive 56% of their income from agriculture, directly or indirectly. The rural poor tend to be employed mostly as agriculture wage workers. The concentration of poor is the highest among categories of households where the head is an unpaid family worker, sharecropper, or owner-cultivator owning less than 2 hectares of land. The poverty headcounts in these categories are 60%, 50% and 40% respectively. Rural Sindh is highly dependent on public services with little role of the private sector. Thus reforms to improve public service delivery and stimulate rural growth that raise agricultural and nonagricultural wages are fundamental for reducing poverty in rural Sindh.

6. GOSINDH STRATEGY FOR PIM - A TOOL FOR POVERTY REDUCTION

A holistic water resources management strategy encompassing policy and institutional improvements, improved management of storages, infrastructure improvement, environmental sustainability, productivity enhancement, and poverty alleviation, is required to address the water recourses management issues. While realizing the need for such a holistic strategy and initiating its preparation, GOSindh has evolved an interim strategy that would yield quick dividends, within the broader constraints mentioned above, while building the foundation for the longer term strategy. This interim strategy has three inter-related elements: (a) fostering an institutional, policy and operational framework conducive to efficient and self-sustaining operation and maintenance of the irrigation system; (b) supporting WCAs in implementing high payoff infrastructure improvements needed for improved water management, particularly at the tertiary level of the irrigation system, at a much accelerated pace, than in the past; and (c) enhancing agricultural productivity and incomes by introducing improved technology, agronomic practices, and information knowledge systems.

The first element of the strategy is predicated upon the implementation of fundamental and far reaching institutional reforms that are being supported under the World Bank funded projects. These reforms involve decentralization and transfer of management of the irrigation and drainage system from the Sindh Irrigation Department to a multi-tier system of autonomous institutions, with clearly defined roles and responsibilities within the system, with a fm commitment to rationalize O&M subsidies. The key elements of the reforms, the hierarchy of the new institutions and their roles and responsibilities are as follows:

(i) conversion of the Irrigation Department into an autonomous Sindh Irrigation and Drainage Authority (SIDA), with responsibility for intra-provincial aspects of the system, including O&M of barrages and main canal head-works, and management of intra-province bulk water transfers, including water deliveries at the head of main canals and management of drainage effluent in main drains that extend across canal commands;

(ii) establishment of self-accounting, commercially oriented, client responsive and financially sustainable area water boards (AWBs) --public utilities-- on each main canal, responsible for operating and maintaining the irrigation and drainage system within the main canal command up to the head of the distributary canals; and

(iii) establishment of FOs, owned and managed by farmers, and responsible for O&M of the irrigation and drainage system within the command area of distributary and minor canals and collection of *abiana* (water charges). FOs would have representation on the AWBs.

The long term vision is that once the new institutions become operational, SIDA would enter into contracts with AWBs for bulk supply of irrigation water and receipt of the drainage effluent generated within the limits of the AWBs. The AWBs would enter into similar contracts with FOs for bulk supply of water at the head of the distributary canals. The FOs will collect *abiana,* retain a part of it and pass on the remaining proceeds to AWBs for maintenance of the main canals. The AWBs would in return pass on a portion of the amounts received to SIDA for the O&M of the system under the latter's jurisdiction. It is expected that the reforms would lead to SIDA and AWBs developing into vibrant autonomous bodies capable of improved management and O&M of the upper tiers of the irrigation system that would result in improved and sustainable operations, higher water delivery efficiency and better scheduling of canal deliveries reflecting more closely the irrigation requirements in canal commands. Establishment of FOs would lead to more equitable distribution of water amongst watercourses, improved and cost effective maintenance and more efficient collection of *abiana.*

The second element of GOSindh's interim strategy **--**supporting communities to carryout

accelerated high payoff infrastructure improvements at the tertiary level-- complements the first element of the strategy, but stands on its own merit. It involves, establishing effective community organizations/user groups at the watercourse, and distributary canal levels to provide a solid foundation for the upper tier reforms. Also, investments to make the irrigation infrastructure functional and efficient are essential to enable the fledgling institutions (WCAs, FOs) to perForm and yield intended outcomes. Overall progress on establishing WCAs and infrastructure improvements at the tertiary level has been slow, primarily due to lack of capacity for social mobilization and capacity building. GOSindh wishes to improve the speed and effectiveness of this program through greater participation by WCAs. In addition, GOP is considering a country wide watercourse improvement program that would include improvement of the remaining 29,000 watercourses in Sindh

The third element of the strategy -- supporting productivity and income enhancement measures- is critical to reap the full benefits of institutional and infrastructure improvements in terms of higher productivity, and to help translate higher productivity into higher incomes. Past interventions in this regard have been limited to a few demonstration centers, routine training & visit (T&V) type extension activities and some efforts at information dissemination. Few attempts have been made to introduce improved technology (land leveling, improved farm layout, zero-tillage, sprinkler drip, etc.) and information systems. The impact has been modest. GOSindh is exploring new and more efficient ways of improving and scaling up delivery mechanisms for new technologies, extension, input supplies, storage and processing, marked marketing information, and modem information systems, including access to internet. Current thinking is that these activities would be developed around the new institutional setup, primarily at the AWBs, FOs, and WCA levels.

7. INSTITUTIONS CREATED AS A RESULT OF PIM IN SINDH

In Sindh, following bodies are to be fully established:

Sindh Irrigation and Drainage Authority (SIDA)

- 13 Area Water Boards
- About 1400 Farmers' Organisations.

Sindh is proud of being ahead of other provinces in implementing these reforms and offering investment implementation opportunity to FOs. The overall status of establishment of new institution is as under:

- SIDA- fully established and functioning
- AWBs- Three AWBs on four main canals (Nara, Ghotki, Phuleli and Akram Wah) are functional
- FOs- more than 220 FOs established- mostly in Nara Canal AWB command area

8. IMPLEMENTATION OF MODERNIZATION SCHEMES

Under Sindh On Farm Water Management (SOFWM) Project, 100 distributaries / minors managed by Farmers Organizations (FOs) are being rehabilitated / improved in three Area Water Boards i.e. Nara Canal Area Water Board (NCAWB), Left Bank Canal Area Water Board (LBCAWB) and Ghotki Feeder Canal Area Water Board (GFCAWB). The rehabilitation / improvement works include:

- Restoration of outlets, weak sections of channel banks & berms
- De-silting
- Repair of regulator gates, cross regulators and diversion structures
- Protection works upstream and downstream of structures and channel sides
- Construction of cattle crossings and cattle *ghats* (cattle drinking water points)
- Installation of gauges and control structures for flow measurement at the Distributary head and each *Mogha* (watercourse off take outlets).

At present around 175 irrigation channels have been transferred to FOs and about 100 distributary/ minor canals, that are managed by FOs, are planned to be rehabilitated through a project of Sindh On farm Water Management funded mainly by the World Bank. FOs are responsible to act as contractor for the rehabilitation of their own distributary/ minor canal in case of less than US$ 100,000 contract amount through Community Based Contract (CBC). On the other hand, if amount exceeds US$ 100,000, the contract could be awarded to the private contractors through National Competitive Bidding (NCB) and FO becomes employer of the contractor. The works are identified and proposed by FOs on the basis of joint walk-through surveys along with AWB staff,, consultants and social mobilization teams of Social Development Cell SIDA.

In first year 10 contracts were awarded of which 09 were NCB and one was CBC. In first year the maximum limit of CBC work was US$ 30,000 and based on the first year performance, environmental compliance and work quality review, the GoSindh and World Bank agreed to extend upper limit of CBC up to US$100,000. This directly resulted in a greater opportunity to many FOs to undertake investment activity directly under their management and execution.

8.1. PARTICIPATION IN JOINT WALK THROUGH

In order to identify the work a joint walk through is carried out. The joint walk through largely helps in determining the scope of rehabilitation work for FO. At the end of walk through, a format is jointly signed by all the parties incorporating all the technical requirements, repair needs and necessary irrigation structures. At the same time, environmental impacts of the rehabilitation works are also assessed jointly along with any resettlement impact of the works. In addition through the survey identification of community infrastructures like washing bays, buffalo baths, and foot bridges are proposed on appropriate places with consultation of FO members.

Some committees are formed by FOs to manage the rehabilitation work, monitor the work, and implement the CBC works.

8.2. PARTICIPATION IN CONTRACT BIDDING AND AWARD

After joint walkthrough and detail designing, tender documents are prepared and based on the cost estimation bids are invited for NCB works (costing more than US 100,000) and evaluated in presence of the FO representatives. The contracts are awarded by the FO in capacity of employer and FO Chairman Signs the agreement with selected contractor. This process creates ownership of FOs and ensures sustainability.

As stated earlier, under the rehabilitation works program of irrigation channels, initially it was decided that contracts worth less then US$ 30,000 will be awarded to FO as part of institutional strengthening measure. And later on this limit was enhanced to US$ 100,000. In the first year of program of works, only one contract was awarded as CBC contract (FO Bagi minor in NAWB). Whereas in second year, out of 35 contracts, 21 were classified as CBCs. This enhancement in the upper limit for contract amount was appreciated by the FO community at large. By and large, the performance of CBC has been satisfactory as local labor and local machinery like tractors and excavators are hired, generating employment opportunities at local level. The contractors on the contrary largely bring their manpower and machinery from their own pool of resources, mostly located outside of the project area. Community appreciated the donor and govt. efforts for awarding the contract to FOs.

8.3. PARTICIPATORY MONITORING

Generally there is a strict monitoring by FOs on the rehabilitation works at most places. FOs generally form a committee to address the quality work and ensure work is completed as per scope. The contractors' exerted political pressures to obtain the bills in advance but the FOs withstand the pressure and forced contractor to complete the work. For example contractor of Mir Minor exerted pressure on FO chairman to release his final bill before the completion of work. But chairman took stand and described to contractor clearly that bill could not be signed before the work was completed.

9. PIM IN SINDH: - ACHIEVEMENTS AT GLANCE

- **Community Participation:** farming community through participatory irrigation management has effectively been involved in management and distribution of water at minor and canal level. More than 100,000 farmers have taken part in the social mobilization process and promoted institutional reforms.
- **Control of Water Theft:** After implementation of PIM, the AWBs have been some how succeeded to control the theft and closing the illegal direct outlets. The World Bank Aide Memoire (Feb 2005) further recognizes improvement in the water management due to irrigation reforms. It mentions that *"The left Bank Canal AWB with the support of SIDA and IPD closed several illegal outlets in the lined canal which served an area of about 20,000 ha. For the first time in 3 years the tail end farmers received water"*.
- **Better and reliable service delivery:** The water service delivery has also been improved under reform programe. The DPR value has been observed more for the area which is managed by FOs. An other World Bank Implementation review mission on SOFWM project (refer Aide Memoire May 27, 2005) maintains that *" the mission observations during field visits that in distributary canals where farmer organizations are functional and physical and hydraulic improvements are being implemented, water is now reaching the tail-end farmers who had reportedly never received their due share in the past"*.
- **Better management of investment and modernization schemes:** A world Bank mission on same project while visiting one FO Channel (Bagi minor that is undertaking rehabilitation work by them) maintains in their Aide Memoire (Dec 2005) that **"** *This is the first community based contract and the quality of work observed was good. The management committee was exemplary and seemed to be working well together in a participatory and democratic manner"***.** The M&E consultants (M/s MMP) of SOFWM project has recently concluded that out of 10 rehabilitation works on FO channels, work under undertaken by FO Bagi (under community contract) was more environmental friendly than other 9 contracts being implemented through contractors. This is remarkable finding in term of quality work and sustainability of the irrigation and drainage system due to reforms.

- **Reduction in Poverty and socio-eco distress:** It has also been witnessed that in many areas where people migrated earlier from tail area due to water shortage have returned back to cultivate their lands as they can now receive water which was being stolen through direct outlets at head reach. This happened mainly in the Left Bank Area Water Board. This all has happened due to reforms in irrigation sector. The recent report published by World Bank on Pakistan Water Economy running dry also appreciates Sindh and recognizes that Sindh has made commendable progress in institutional reforms in irrigation (refer page 103 of the report).
- **Water Distribution equity:** unauthorized discharges from direct outlets are controlled. This has resulted in availability of water in the tail end area of Nara and Left Bank canal AWB
- **Institutional Development and Governance:** The WCAs and FOs have been acting as water management bodies. All investment works on watercourse and minors are being carried out/managed by the farmers. Te FO Bagi Minor under community contract has been awarded contract for rehabilitation of minor. This will improve operation and maintenance of irrigation system and ensure water availability at tail and reduction in water losses.
- **Increased Agricultural Productivity and land use:** with the good governance of water at AWB and FO level, many people who migrated from tail area have returned back in Left Bank Canal area. The land has again come under cultivation and the yield as improved due to reliable water supply.
- **Reduced water losses:** with the improvement of watercourses and effective O&M by FOs the losses have decreased
- **Reduced Environmental degradation:** the industrial units especially sugar mills used to pollute drains and water ways by putting their effluent. The mills have agreed to install treatment plants.
- **Change in cropping pattern/water use efficiency:** farmers have started growing water resistant crops (sunflowers) especially in Left Bank AWB area where sugarcane and rice used to dominate.

10. CONCLUSION

PIM has evolved and become generally accepted as a necessary aspect of productive and sustainable irrigation. The schemes of modernization of irrigation channels are an excellent opportunity to address the issues of sustainability of FOs, sustainable water resource management. The FO managed investment schemes have not only addressed the local employment issues of landless agriculture and rural worker but also has addressed the water equity and efficiency as well. The increased farm productivity and income has reduced poverty from the rural poor. In Sindh PIM has proved to be successful model. But it is long way to go and government still needs to support and create support services for sustainability of reforms in Sindh. An empowerment model has to be followed and enabling environment for these new institutions has to be created.

There is a need to maintain the transparency and create support service for institutions created under reforms, particularly FOs and AWBs.

11. REFERENCES

1. Azad, Aslam Rasheed and Yameen. 2003: Sindh Water Resources Management-Issues and options published by Investment Centre FAO
2. Johnson, Sam H. III, Mark Svendsen, and Fernando Gonzalez. 2002. Options for Institutional Reform in the Irrigation Sector. Discussion paper prepared for the International Seminar on Participatory Irrigation Management, 21-27 April, Beijing, China.
3. Nazeer 2004, IWRM- a tool for poverty reduction, published by Pakistan Water Partnership, Islamabad Pakistan
4. Nazeer, "Participatory Irrigation Management and Indus Basin Irrigation System-A case study of Pakistan" published in EC (DGI) Regional Action Program " Participatory Irrigation Management (PIM) Vol. 2, country over view of PIM, Mediterranean Agronomic Institute, Bari- Italy Sept. 12-22, 2001
5. SDSC 2006, Third Party Monitoring and Evaluation of Institutional Reforms in Sindh- Final Report
6. SDC-SIDA (2006). Monthly Progress Reports
7. Vermillion, Douglas L. Forthcoming. Irrigation Sector Reform in Asia: From Patronage under Participation to Empowerment with Partnership. In Asian Irrigation in Transition. Edited by G. Shivakoti, D. Vermillion, E. Ostrom, R. Yoder, W.F. Lam and U. Pradhan. New Delhi: Sage Publications.
8. Vermillion, Douglas L. and Juan A. Sagardoy. 1999. Transfer of Irrigation Management

   Services: Guidelines. FAO Irrigation and Drainage Paper Number 58. Rome: FAO, IWMI and GTZ.

9- World Bank Aide Memoirs (2004-2006) on NDP and SOFWM Projects

10- World Bank (1993). Pakistan Irrigation and Drainage: Issues and Options Report No. 11884-PAK

11- World Bank (2004). Project Appraisal Document Sindh On-farm Water Management Project, March 4, 2004 Report No. 27982-PKAK

12- Yameen and Nazeer (2001). Are farmers willing to contribute for operation and maintenance of Drainage System? Proceedings 2nd National Seminar on Drainage in Pakistan, April-18-19, 2001-University of Agriculture Faisalabad

A PERFORMANCE STUDY OF PARTICIPATORY IRRIGATION MANAGEMENT IN EASTERN INDIA: OBJECTIVES, RATIONAL OF CONCEPT AND NEED

Sushanta Kumar Mahapatra[1]

ABSTRACT

Main motivations of this paper is to examine the functioning and otherwise of Water User Association (WUA) or Pani Panchayat promoted by the State and the local traditional irrigation institutions and to evaluate their functioning & characteristics in the context of local water management in the Hirakud Command Area (HCA), of Orissa state in Eastern India. The specific objectives are; (1) to contrast the formal and informal institutions in terms of their formation, performance and success, (2) to examine about the peoples participation and their liveliness, (3) to recommend policy interventions to make the formal institutions more successful. The paper concludes that the Pani Panchayat as regulatory institutions in charge of water distribution on equitable basis, their performance has been reasonably weak and unsuccessful. Even though Pani Panchayat has been initiated and endorsed in the State for more than a couple of years, the acceptance of the model have been lethargic and scattered.

Key Words: Common Property Resource, Farmer Managed Irrigation System, Formal & Informal Irrigation Institutions, Orissa, India, Pani Panchayat, Participatory Irrigation Management, Water User Association, Water Management

I. CONTEXT OF THE STUDY

Recently Pani Panchayat (Water Council) as an institution in irrigation management and research in the collective management of Common Property Resources (CPRs) has paying attention of many researchers and policy makers. The current paper deals with an evaluation of water management through community participation and emergence of Pani Panchayat in a case study of Vir Bajrang Bali Pani Panchayat under Lift Irrigation Project of the Hirakud Command Area (HCA), of Orissa state in Eastern India. We are aware that, it is incredibly near the beginning to assess and evaluate the formal Pani Panchayat in the state, as the practice of implementation is just falling on the line.

1- Research Scholar, Madras Institute of Development Studies (MIDS), No-79, Second Main Road, Gandhi Nagar, Adyar, Chennai-600 020 (Tamil Nadu), India Email: sushantamids@hotmail.com

Irrigation Management Transfer (IMT) to the user farmers is being increasingly advocated and practiced the world over, to provide correctives to the distortions arising from the failure of the market as well as the state. The most common type of reform in the Indian irrigation sector in recent years has been the attempts to increase farmer's direct involvement in irrigation under the label of PIM. Such reforms are directed for improving the performance of irrigation by involving who have the greatest stake in irrigation, in the operation & management of systems.

Utmost painstaking efforts have been made in a number of countries worldwide to transfer the rights and responsibilities for irrigation management activities of an irrigation system from a Government agency to private or local organisations (Brewer *et al.*, 1999, Vermillion, 1997). Transferring responsibilities has come to be seen by policy-makers as a way to lessen pressures on thinly stretched Government finances, while at the same time, improving irrigated agricultural production and ensuring the long-term sustainability of irrigation systems (Geijer et al., 1996, Kloezen and Samad 1995, Vermillion 1991). The Philippines (Wijayaratna and Vermillion 1994, Svendsen 1992), Indonesia (Soenarno 1995), China (Xu Zhifang 1995) and Sri Lanka (Ratnayake 1995) in Asia, Mexico (Johnson 1997) and Columbia (Garcia- Betancourt 1994) in Latin America, and other countries New Zealand (Farley 1994) and Turkey (Devlet su Isleri *et al.*, 1996), have foremost efforts in this track. One study on a survey of the impact assessment IMT was carried out by the IIMI and the IIMA (Naik *et. al.*, 2002). Brewer *et. al.*, study (1999) found that, in India, increasing user participation in the management of irrigation systems is being tried as a means to reduce the pressures on Government finances, improve the performance of irrigated agriculture, and ensure sustainability of irrigation systems. An analysis of scattered studies concludes that the various evidences shows a combination of positive and negative consequences, but the majority studies report positive results, particularly improvements in water distribution and finance (Vermillion 1997). But this review study also shows that, the different studies are not comparable, nor is it comprehensive.

FORMAL VS. INFORMAL IRRIGATION INSTITUTION

Recently major debate is in the region of the subject matter of formal vs. informal institution. An effort has been taken to discuss both formal and informal traditional irrigation institutions or FMIS and its sustainability, importance and participation in the decision-making and the proper monitoring of the behavior of the members. Why focal point on institutions? Institutions could be arranged into two ways: formal and informal. A government agency is a formal institution as it has rules, which are officially laid down in a written form. Farmers' institutions could be both formal and informal. An institution which has written rules, is termed as formal, where as an institution, which does not have written rules, is an informal institution. In many of the informal institutions (FMIS) the rules are not in written form but they are practiced for a long period of time. They serve as a rule in their day-to-day interaction.

The management of irrigation systems requires strong institutions, because they have to manage the distribution of scare resources and this can lead to various types of conflicts. Ostrom (1992) points out conflict management as critical for self-governing irrigation systems, and Vermillion (1996) restates this as an important factor in the context of irrigation management transfer programs. The governance of FMIS can be studied by looking at various rules in use. E.Ostrom (1992) observes institutions as rules-in-use, which define the rights and responsibilities of the water users. Ostrom (1990, 1993) characterize that an institution is the rules actually used (rules-in-use or working rules) by a set of individuals to organize repetitive activities that produce outcomes affecting those individuals and potentially affecting others. In a world of uncertainty they have been used human beings in an attempt to structure human interaction. They are rule of the game of a society and in consequence provide the framework of incentives that shape economic, political and social organization.

On the other hand North (1944, p.360) emphasize that, Institutions as a combination of "formal constraints (e.g. rules, laws, constitutions), informal constraints (e.g. norms of behavior, conventions, self-imposed codes of conduct) and their enforcement characteristics)". Enforcement is carried out by third parties (law enforcement, social ostracism), by second parties (retaliations) or by the first party. An institution is "… an enduring, complex, integrated, organized, behavior pattern through which social control is exerted and by means of which fundamental social desires and needs are met (Fairchild, 1955 cited in Dusseldrop, 1993; 56). Organisations can be defined as 'groups of individuals bound by some common purpose to achieve objectives' (North 1990: 5). They are identified by roles (Coward 1980; Uphoff 1992). Institutions are identified by the rules, shared understandings, or norms held by a group of people (Coward 1980; North 1990; Uphoff 1992). The most important of these sets of rules, from the standpoint of resource management, are those governing access, withdrawal, and, management, or those related to monitoring, enforcement, and sanctions governing resource use (Ostrom 1992).

Norman Uphoff (1986a) also opines that institution as composite of norms and behaviour that persists overtime by serving collectively valued purposes. An institution is a combination of roles, rules, procedures, a practice and a system of relations. These definitions emphasize different elements of institutions rules constituted in a group requiring a complex of practices and control. Besides, these definitions discuss the performance of the role by an individual and the rules that regulate actions of the individuals/groups. The action is always guided by the role expected by other members of the community and one is judged by the performance associated with the role. Coward (1985) alleges that this role expectation and role performance are the institutional and organizational dimensions respectively which are regulated by the rules. It has to be realized that institutions are not functioning in vacuum. Changes in the political environment and opening up of the villages are changing the strength of social control, which is of great importance for the functioning of the institutions. The well functioning institutions will have greater control on the use of resources and its distribution.

II. OBJECTIVES

MAIN OBJECTIVE

Broad objective of this paper is to examine the functioning and otherwise of Water User Association (WUA) or Pani Panchayat promoted by the State and the local traditional irrigation institutions and to evaluate their functioning & characteristics in the context of local water management in the Hirakud Command Area (HCA), of Orissa state in Eastern India.

SECONDARY OBJECTIVES

The secondary objectives are;

(1) to contrast the formal and informal institutions in terms of their formation, performance and success,

(2) to examine about the peoples participation and their liveliness

(3) to recommend policy interventions to make the formal institutions more successful.

III. FUNCTIONING OF PANI PANCHAYAT/WUA

IN HIRAKUD COMMAND AREA, ORISSA

The Hirakud Command Area Development Authority[1] reveals the fact that during 1999-2000, seven water user's Association (WUA) were organized and got registered under the societies Registration Act, 1860 in villages of *Kumelsingha, Babebira, Lahoula, Paharsirgida, Kulunda, Sahajbahal* and *Sulunda*. Of course regrets the CADA, these WUA could not be made operative in the absence of detailed functional guidelines of government. Information on the extent of farmer participation is illusory. The number of registered WUAs, often used as an indicator of participation**,** is ambiguous. Many registered WUAs exist only on paper in HCA. On the other hand, we have inadequate information on instances of real participation of users which have not resulted from any roles officially granted to them

IV. RESEARCH METHODS

In order to examine the functioning and impact of transfer of irrigation management to the water users, a detail survey of 70 households (HH) has been done in a case study of *Vir Bajrang Bali* Pani Panchayat under Lift Irrigation Point (LIP) of the Hirakud Command area, Orissa. The Primary data has been collected from *Bandhapali* village of *Kardola* Panchayat in *Dhankauda* Block comes under Sambalpur district. The *Bandhapali* village is 32 KM away from the district headquarter Sambalpur. The nearest railway station is at Hirakud 24 KM far from the village. *Bandhapali* is a revenue village of *Kardola* Panchayat consists of one ward.

Both quantitative and qualitative information are obtained in order to observe the efficacy of different types of institutional arrangements. Qualitative information is obtained by way of Participatory Rural Appraisal (PRA) use such as focus group discussions, key person interviews like senior citizens, officials in the irrigation department. Discussion were also done with the office bearers of the concerned PP, in addition to those expelled from the PP i.e. woman and landless people. Two structured questionnaires; one related to WUAs and another related to households, were prepared

1- Hirakud Command Area Development Authority (1999) – Annual Administration Report to collect quantitative information. These interviews unscheduled, and carried out in variety of locations like in a school house or Panchayat building, on a temple veranda, under a tree, or in private homes. Before and after scenarios were exploited to evaluate the impact as there is no option for with and without scenario, as all the farmers getting irrigation water are covered under Pani Panchayat. The field work was conducted during the period 2004-2005.

V. MAJOR FINDINGS OF THE STUDY

PEOPLE'S PARTICIPATION, INSTITUTIONAL AND ORGANISATIONAL ASPECTS

We asked the PP member about the different aspect of PP such as knowledge about working group, user group and PP committee, and their views were described below.

PANI PANCHAYAT WORKING GROUP IN THE VILLAGE:

The committee of PP in Orissa shows that, they are formal in the sense that the Government recognise them as having the authority to enforce the Panchayat decisions. The Nepal experience on Farmer Managed Irrigation System (FMIS) shows that at the central level usually the organisation comprises a general assembly of beneficiaries and a committee consisting of members elected to carry out the decisions made by the general body.

COMPOSITION OF THE PANI PANCHAYAT COMMITTEE

The total number of members in a PP Committee varies from area to area depending upon the size of the command area, the complexity of the water distribution methods employed and the respective land holding of the farmers. Each of the PP constitutes a President, Secretary, Vice-President and a Treasure. Other members of the PP usually represent different areas of the system. Their functions are to help with water distribution and conflict resolution within their respective areas and to help mobilise resources for canal maintenance and repair.

SELECTION OF MEMBERS

The user group members usually elect the members of PP committee. Here when the Water User Association was registered in 1997 for the first time members were nominated by the Government officials. During the meeting held on 21st August 2002 the committee members were again changed and that too by nomination with the help of Government officials. In Nepal FMIS, generally the members have been selected on the basis of the Panchayat head, hereditary, land holding, rich people or head of the village. Whether a PP opts for a hereditary committee president or an elected one, influenced by so many factors like

1. The age of the PP
2. The number of beneficiaries

3. The size of the PP
4. Access to a road and
5. The number of levels in the PP.

From the Table-1 it shows that, the process of electing the president is through nomination as 100 per cent responded that it is through nomination. 79 per cent members responded that there is no political interference in the working of the PP committee (Fig-1). The wards of the village are politically demarcated boundaries; the hydrological boundaries of the PP may extend beyond. The various activities in the PP are taken over by the president. The landless farmers were 29 per cent satisfied with the functioning of the PP committee. Among the marginal farmers 34 per cent were satisfied with the committee, while majority 66 per cent are not satisfied. Majority of medium farmers (75 per cent) are not satisfied. 62 per cent of the small farmers are not satisfied with the functioning. On the contrary, only 17 per cent of the large farmers are not satisfied with the functioning of the PP Committee.

Fig-1

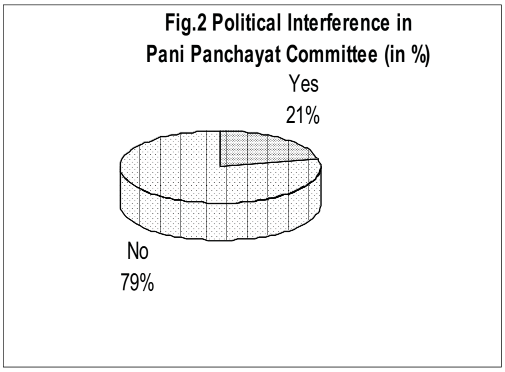


Fig-2

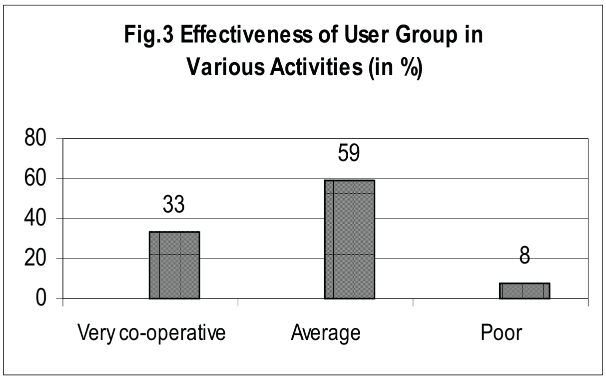


Table-1: Aspects on Pani Panchayat Committee

Size class of Land holdings (in Acres)	No of HHs	Election Process		Political interference			Process of electing President		Who takes over various activities			Are you satisfied with the function of PP committee	
		Voting	Nominated	Unanimous	Yes	No	Nomination	Election	President	Democratic process	Any other	Yes	No
1	2	3	4	5	6	7	8	9	10	11	12	13	14
0.00-0.00	7	-	100	-	20	80	100	-	100	-	-	29	71
0.01-2.50	24	-	100	-	17	83	100	-	100	-	-	34	66
2.51-5.00	20	-	100	-	22	78	100	-	100	-	-	25	75
5.01-10.00	10	-	100	-	16	84	100	-	100	-	-	38	62
10.01 & above	9	-	100	-	29	71	100	-	100	-	-	83	17
Overall	70	-	100	-	21	79	100	-	100	-	-	42	58

Source: Field Survey (2004-05)

Note: i) All Figures in the table indicate the responses in terms of percentages of the respective categories except in Col 2.

ii) Blank entries in the Table denote nil.

Table-2: Aspects of Pani Panchayat on User Groups (UGs)

Size class of Land holdings (in Acres)	No. of HHs	Effectiveness of User group in various activities			If poor, Reasons for Non-cooperation among the members				Activities done by User Groups		
		Very co-operative	Average	Poor	Caste conflict	Land disputes	Party politics	Any other	Plan/Design of construction work	Cost estimate of work	Maintain the account
1	2	3	4	5	6	7	8	9	10	11	12
0.00-1.00	7	23	65	9	38.58	18.28	-	-	No Comment	No Comment	No Comment
1.01-2.50	24	25	63	17	78.01	15.68	-	-	No Comment	No Comment	No Comment
2.51-5.00	20	29	62	9	21.08	-	-	-	No Comment	No Comment	No Comment
5.01-10.00	10	32	64	4	15.02	-	23.85	-	12	30	58
10.01 & above	9	59	37	4	10.09	-	28.09	-	22	30	38
Overall	70	33	55	8	22.55	-	-	-	-	-	-

Source: Field Survey (2004-05)

Note: i) All Figures in the table indicate the responses in terms of percentages of the respective category as except in Col.2.

ii) Blank entries in the Table denote nil.

ACCOUNTABILITY OF THE COMMITTEE OF THE PANI PANCHAYAT

The Committee is responsible for keeping accounts, distributing water in accordance with directives of the Governing body, implementing decisions made during the general meeting and resolving conflicts. The day-to-day affairs of the 'Association' shall be governed by the management committee. The executive body is consisting of president, Vice-president, Secretary, Treasurer and all members of the Chak Committees. The Secretary keep up a register of all transactions related to PP. The Secretary of the concerned PP is having a trading business as his main profession, leaving little time to take charge of water distribution. There are different function and power of the executive body such as

a. The executive body shall have powers and duties necessary for the administration of the affairs of the 'Association' in keeping with the provision of the bye-law.
b. Designate employ on remuneration and dismiss personal necessary for the operation and drainage system.
c. They take care of, upkeeps and surveillance of irrigation and drainage systems in the area if operation of the 'Association' and the common areas and facilities.
d. Levy charges for operation maintenance and repairs of irrigation and drainage system.
e. Collect water rates/ charges contributions from owners and remit Government dues.
f. See that cash book is written promptly and is signed by the treasurer.
g. Sanction working expenses, count cash balance, engage labour, organize labour contribution from land owners or award contracts for O & M of irrigation and drainage system.
h. Educate farmers in cropping pattern, water management, optimal and efficient use of water and inputs for increasing agricultural production yields and their profits through trained Irrigation Community Organised (I.C.O.)
i. Inspect irrigation and drainage system, distribution of water.
j. Scrutinise accounts kept by Secretary and/ or Treasurer and examine the registers and accounts books and take steps for the recovery of all sums due to the 'Association'.
k. Allow Chak committees and others to organize and carry out repairs of irrigation and drainage systems under their respective outlets, if so desired by themselves through labour and materials contributions.

If the committee will not function properly the powers will be delineated, and also if any member other than the office bearers of the executive body without sufficient reasons given in writing to the executive body will automatically ceased to be a member of the executive body. Office bearers can also be removed upon and affirmative vote by a majority (more than 50 per cent of the member present) of members of the general body of the 'Association' any of the office bearers may be removed with cause and his successor elected as per procedure laid down.

USER GROUP

A Water User's Association is an 'Association' of all persons owning land within a hydrological delineated portion of the command area varying in size from 300-600 Ha. It may be for each distributary or minor or sub minor canal area including direct outlets clubbed to them. The association will be formed and registered after enrolment of minimum 51 per cent of members. The entire land owner within the jurisdiction of 'association will have right to become members of the association'. The activities of the user group is

1. Ensure collective and community responsibility of the farmers to collected water charges from water users and payment to government from time to time.
2. Demonstrate and practice improvements on firms' water management, method for improve field operation efficiency in the individual firm's field.
3. To maintain and operate the minor/ Distributary/ laterals, FCI/FDC etc including lining earth work, structures etc. Already turned over by government to the control of "Association" by meeting the expenditure from out of the operation and maintenance (O and M) fund created by "Association".
4. The "Association" will resolve disputes among farmer's in respect of water distribution and allied matters.
5. Develop the sense of economy in water use amongst the users.

The user group is formed on the basis of location, activities, pre-location technology. It is also based on limit of area and budget. The group has no president, the whole group is unanimous. It has been argued that uniformity of social economic conditions prevalent in a co-operation conversely neutral differentiated groups tend to re-enforce the differentiation. Access to potential benefits of the scheme by the members of the collective is discriminatory. This constitutes a disincentive for co-operation effort by those who perceive the benefit as beyond their reach. Unless specific measures are taken to redress this imbalance, it discourages the reproduction of the co-operative spirit. Due to this the field study shows that majority of the members (59 per cent) are medium average co-operative and 33 per cent are very co-operative and only 8 per cent are less or not or poor co-operative (See Table-2 and Fig-2). The field work also shows that landless farmers are 69 per cent co-operative in average scale, among the marginal farmers 25 per cent are very co-operative and 76 per cent are average. Among the small farmers 9 per cent are not at all or we can say poor co-operative and 62 per cent are co-operative averagely. On the contrary, majority (59 per cent) of the large farmer responded that, User groups are very co-operative. Thus the study shows co-operation increases with increase in farm size. Table-2 depicts that, those 9 per cent from small farmer groups which are less or poor co-operative, are due to caste conflict. There were no comments in relation to the UGs co-operation regarding planning/design, supervision of construction work, cost estimation of works etc. The UG is very co-operative and active because they are from the same or near by village and they are the relative or neighbours to the person concern.

VI. CONCLUDING OBSERVATIONS

An analysis on various aspects of Pani Panchayat Committee from the farmers view points showed that many farmers had no idea about the PP Programme. The landless farmers were 29 per cent satisfied with the functioning of the PP committee. Among the marginal farmers 34 per cent were satisfied with the committee, while majority 66 per cent are not satisfied. Majority of medium farmers are not satisfied. 62 per cent of the small farmers are not satisfied with the functioning. On the contrary, only 17 per cent of the large farmers are not satisfied with the functioning of the PP Committee. Our field study analysis of Pani Panchayat on User Groups showed that majority of the members are medium average co-operative and 33 per cent are very co-operative and only 8 per cent are less or not or poor co-operative. The field work also revealed that landless farmers are 69 per cent co-operative in average scale, among the marginal farmers 25 per cent are very co-operative and 76 per cent are average. Among the small farmers 9 per cent are not at all or we can say poor co-operative and 62 per cent are co-operative averagely. On the contrary, majority of the large farmer responded that, User groups are very co-operative. Thus the study showed, co-operation increases with increase in farm size.

We can conclude that the PP as regulatory institutions in charge of water distribution on equitable basis, their performance has been reasonably weak and unsuccessful. This endures unfavorably on their capacity to generate resources through collection of water cess. Researchers have drawn up a strategy for policy makers to ensure IMT programs become more pro-poor stressing the need to clearly define the rights of farmers, raise awareness of these rights, reform the election process, and monitor participation in water user authorities. [1] Despite the fact that the irrigation agency in Orissa has taken policy decision to encourage farmer's participation and attempts are underway to motivate farmers to form WUAs, the farmer's response in this regard is not up to the level of satisfaction (Swain; 2000: 128). The State should act as a facilitator not controller. PP do not imply that the state would completely withdraw from irrigation, but would continue to provide critical services, particularly water supply at main delivery points, providing information, training and accounting are required to support PP.

Even though PP has been initiated and endorsed in the State for more than a couple of years, the acceptance of the model have been lethargic and scattered. There is no promptly accessible data to evaluate this performance. As a whole PP is an unexecutable and unacceptable. PP is not in the interest of the people. There are so many constraints like selfishness, illiteracy, no interest due to big landowners, which hinder for the improvement of PP.

A detailed action plan should be prepared in consultation with the water users through Participatory Rural Appraisal method. A feasibility study should be under taken by examining the caste class conflict, groupism, political differences and history of confrontation and conflict if any. It is necessary to apply bottom-up approach instead of top-down for sustainability. There must also be mechanisms to ensure that the benefits of the project are equally distributed to all concerned stakeholders. The Government

1- For detail discussions, see The Water Policy Briefing Series (www.iwmi.org/waterpolicybriefing).

should review its decision of making the availability of irrigation water conditions to the formation of PP. Many registration actions of PP are complex and long, raising the costs of participation for the farmers. Simpler procedures are needed that still provide the PP organisations with sufficient legal standing to deal with government agencies, contract with private firms, contractors, and control resources within the group.

APPENDIX

PROFILES OF THE SELECTED PANI PANCHAYAT (PP)

Name of the PP: Vir Bajrang Bali Pani Panchayat (Lift- I & II)

Location: Village: Bandhapali Gram Panchayat: Kardola, Post office: Chiplima Block: Dhankauda District: Sambalpur, State- Orissa, Country- India

Age of the system: Old registration 1996-97 as WUA, Newly formatted in 2001-02 as PP

Type of the system: Lift Irrigation (LI)

Total No of LI Points: Lift I and II

Name of the Source: Mahanadi River

Area in acre (ayacut): 123.66 Acre

Horse Power Used: 15 HP (Horse Power)

Office Bearers: Total No. of PP members: 63 No. of Committee members: Four

President Election: Nomination

REFERENCES

1. Brewer, J.D., S. Kolavalli, A.H. Kalro, G.Naik, S. Ramnarayan, K.V.Raju and R.Sakthivadivel, (1999): “Irrigation Management Transfer: Policies, Process and Performance”, New Delhi, Oxford and IBH Publishing Company.
2. Coward Jr, E Walter (1980): *Irrigation and Agricultural Development in Asia* (Ed): Perspectives from the Social Sciences, Cornel University Press, Ithaca and London.
3. ------------- (1985): “Technical and Social Change in currently irrigated Regions: Rules, Roles and Rehabilitation”. In *Putting People First,* ed M.M. Cernea, pp.27-51. Oxford University Press.
4. Devlet su Isleri, Economic Development Institute, International Irrigation Management Institute (1996): “Assessment of IMT in Turkey”, Paper presented for the International Seminar on Participatory Irrigation Management, Antalya, Turkey, 10-17 April.

5. Farley, Peter J., (1994): "Privatisation of Irrigation Schemes in New Zealand, Short report Series on Locally Managed Irrigation No.2, International Irrigation Management Institute, Colombo.

6. Geijer, Joost CMA, M Svendsen, and DL Vermillion, (1996): "Transferring Irrigation Management Responsibility in Asia: Results of a Workshop", Short report Series on Locally Managed Irrigation No.13, International Irrigation Management Institute, Colombo.

7. Garcia-Betancourt, Gilberto, (1994): "The Emergence of Federriego: The Colombian Federation of Irrigation Districts", Short report Series on Locally Managed Irrigation No.8, International Irrigation Management Institute, Colombo.

8. Government of Orissa (2002): Pani Panchayat in Orissa, Department of Water Resources

9. Government of Orissa (2002): The Orissa Gazette: The Orissa Pani Panchayat Act, 2002 No.1053, July 8, Cuttack.

10. Johnson, Sam H, (1997): "Irrigation Management Transfer in Mexico: A Strategy to Achieve Irrigation District Sustainability", Research Report No. 16, International Irrigation Management Institute, Colombo. Iyer R Ramaswamy (2003), Water Perspectives, Issues, concerns: *Sage Publications of India Pvt Ltd,*

11. Kloezen, Wim, and M. Samad (1995): "Synthesis of Issues Discussed at the International Conference on Irrigation Management Transfer, Wuhan, China, 20-24 September 1994" , Short report Series on Locally Managed Irrigation No.12, International Irrigation Management Institute, Colombo.

12. Naik, Gopal, Amarlal H.Kalro, Jeffrey D. Brewer, M.Samad and R.Sakthivadivel, (2002): "Assessing the Impact of Irrigation Management Transfer: Case Studies from Maharashtra", Oxford and IBH Publishing Co. Pvt. Ltd.

13. North, Douglass C. (1990): *Institutions, Institutional Change and Economic Performance*, New York, Cambridge University Press.

14. Ostrom, Elinor (1990): "Governing the Commons, the evolution of institutions for collective action", Cambridge University Press, New York.

15. ---------------- (1992): "Crafting institutions for self-governing irrigation systems". Institute for Contemporary Studies Press, San Francisco

16. ----------------And Roy Gardner (1993): "Coping with asymmetries in the Commons: Self-governing irrigation systems can work" *Journal of Economic Perspectives,* vol.7, Number 4 pp. 93-112.

17. Ratnayake, Ranjith (1995): Irrigation Management Transfer in Sri Lanka, pp79-87 in J.C.M.A. Geijer, ed., "Irrigation Management Transfer in Asia: Papers from the Expert Consultation on Irrigation Management Transfer in Asia", Bangkok and Chiang Mai, 25-29 September 1995, RAP Publication 1995:31, Food and Agricultural Organisation and International Irrigation Management Institute, Bangkok.

18. Sainath, P. (2002): "Little Pani Less Panchayat" *The Hindu,* September 15, 2002.

19. Soenarno, (1995): Irrigation Management Transfer in Indonesia, pp89-98 in J.C.M.A. Geijer, ed., "Irrigation Management Transfer in Asia: Papers from the Expert Consultation on Irrigation Management Transfer in Asia", Bangkok and Chiang Mai, 25-29 September 1995, RAP Publication 1995:31, Food and Agricultural Organisation and International Irrigation Management Institute, Bangkok.

20. Svendsen, Mark, (1992): "Assessing Effects of Policy Change on Philippine Irrigation Performance", Working Papers on Irrigation Performance 2, International Food Policy Research Institute, Washington.

21. Swain, Mamata (2000): "Turning over Irrigation Management to farmers- Issues for Concern" in *Farmer and Local Participation in Irrigation Management,* Gyana Chandra Kar and Mamata Swain (eds), Commonwealth Publishers, New Delhi

22. Tang, S. Y. (1992): *Institutions and Collective Action: Self-governance in irrigation,* San Francisco, Institute for Contemporary Studies Press.

23. Uphoff, Normann (1986): *Improving International Irrigation Management with Farmer Participation- Getting the Process Right,* Studies in Water Policy and Management, No.11, Westview Press, Boulder and London.

24. Uphoff, Normann (1992): *Learning from Gal Oya- Possibilities for Participatory Development and Post-Newtonian Social Science,* Iithaca, NY, and London: Cornell University Press.

25. Vermillion, Douglas L., (1991): "The Turnover and Self Management of Irrigation Institutions in Developing Countries", International Irrigation Management Institute, Colombo.

26. Vermillion, Douglas L., (1997): "Impacts of Irrigation Management Transfer: A Review of Evidence", Research Report No. 11, International Irrigation Management Institute, Colombo.

27. Water Policy Briefing Series (www.iwmi.org/waterpolicybriefing).

28. Wijayaratna, CM, and Douglas L. Vermillion, (1994): "Irrigation Management Turnover in the Philippines: Strategy of the National Irrigation Administration", Short report Series on Locally Managed Irrigation No.4, International Irrigation Management Institute, Colombo.

29. Xu Zhifang, (1995): Irrigation Management Transfer in China, pp157-16 in J.C.M.A. Geijer, ed., "Irrigation Management Transfer in Asia: Papers from the Expert Consultation on Irrigation Management Transfer in Asia", Bangkok and Chiang Mai, 25-29 September 1995, RAP Publication 1995:31, Food and Agricultural Organisation and International Irrigation Management Institute, Bangkok.

INSTITUTIONAL CONDITIONS FOR SUSTAINABLE PIM: CONSTRAINTS AND OPPORTUNITIES

Krishna C. Prasad[1]; Paul van Hofwegen[2]; David J. Molden[3]; and Bart Schultz[4]

ABSTRACT

Participatory irrigation management (PIM), in its various forms, has been implemented all over the world for several decades. PIM-related interventions have generally been made, and continue to be made, in form of a set of project activities mostly implemented over a limited period of time with supports external to the irrigation system. Reported results have been encouraging, particularly during and immediately after the project activities, in terms of improvements in: a) irrigated agricultural performance; b) resource mobilization; c) quality of irrigation service; d) maintenance of irrigation infrastructure; and e) farmers' institutional development. Nevertheless, evidences suggest that sustenance of such gains over a long run is often questionable when there are no favorable institutional conditions after the conclusion of short-lived project activities and withdrawal of external supports. Such institutional conditions include continuation of: i) supporting policies and strategies, ii) capacity building, training, and extension; and iii) monitoring and evaluation. The paper identifies various institutional constraints with the view to identify opportunities to timely instigate possible measures that concern three significant and complementing actors: national/provincial governments, irrigation agencies and/or water users associations, and the irrigators. Conclusions and recommendations are based on in-depth case study of Nepal while reflecting on relevant cases elsewhere.

INTRODUCTION: CLARIFYING PIM AND ITS CONTEXT

Participatory Irrigation Management (PIM) generally implies participation of irrigators in the management of the irrigation system and is generally interpreted as "...the involvement of irrigation users in all aspects of irrigation management, and at all levels" (http://www.worldbank.org/wbi/pimelg/index.htm). 'All aspects' includes planning, design, construction, operation and maintenance, financing, decision rules and the

1- Senior Lecturer, UNESCO-IHE, Institute for Water Education, Westvest 7, P. O. Box 3015, 2601 DA, Delft, The Netherlands. Phone: +31(0)152151825, Fax: +31(0)152122921,
email: k.prasad@unesco-ihe.org
2- Senior Water Management Adviser, World Water Council, France
3- Coordinator, Comprehensive Assessment of Water Management in Agriculture, Sri Lanka
4- Professor, Land and Water Development, Department of Water Engineering. UNESCO-IHE, Institute for Water Education. The Netherlands.

monitoring and evaluation of the irrigation system. 'All levels' means the primary, secondary and tertiary (and subsidiary) levels of water distribution network in the irrigation systems.

Most irrigation systems, both surface and groundwater, by their management mode, can be categorized in three types: (a) agency-managed irrigation systems (AMISs); primarily managed by the state or state-appointed entity (agency) with very little or no involvement of the irrigating farmers, (b) jointly-managed irrigation systems (JMISs); in which irrigators and the agency jointly manage the irrigation system, and (c) farmer-managed irrigation systems (FMISs); wherein most management responsibilities rest with (or have been transferred to) the irrigators. In all three situations, both the irrigators and the agency are involved in the irrigation system management. However, the extent and mode of their involvement varies. In AMIS, the irrigators have little space for their organized and systematic involvement or participation, whereas in farmer-managed (or management-transferred) cases (FMISs), irrigating farmers are the main managers. In the intermediate stage of joint-management, both irrigators and the agency share management responsibilities. Thus, in an encompassing sense, the concept of PIM is evident in all scenarios, nevertheless, in varying degrees; with the exception in completely private irrigation systems owned by individuals or private firms.

The AMIS and FMIS represent two extreme management scenarios which respectively indicate a higher involvement of agency (conversely, lower involvement of irrigators) in AMIS and vice versa (**Figure 1**). These extremes can be conceived in the form of a management continuum in which the extent of agency's involvement decreases as the management mode changes from that of an AMIS to more and more of an FMIS. This continuum represents a domain in which the process of PIM is planned and adopted.

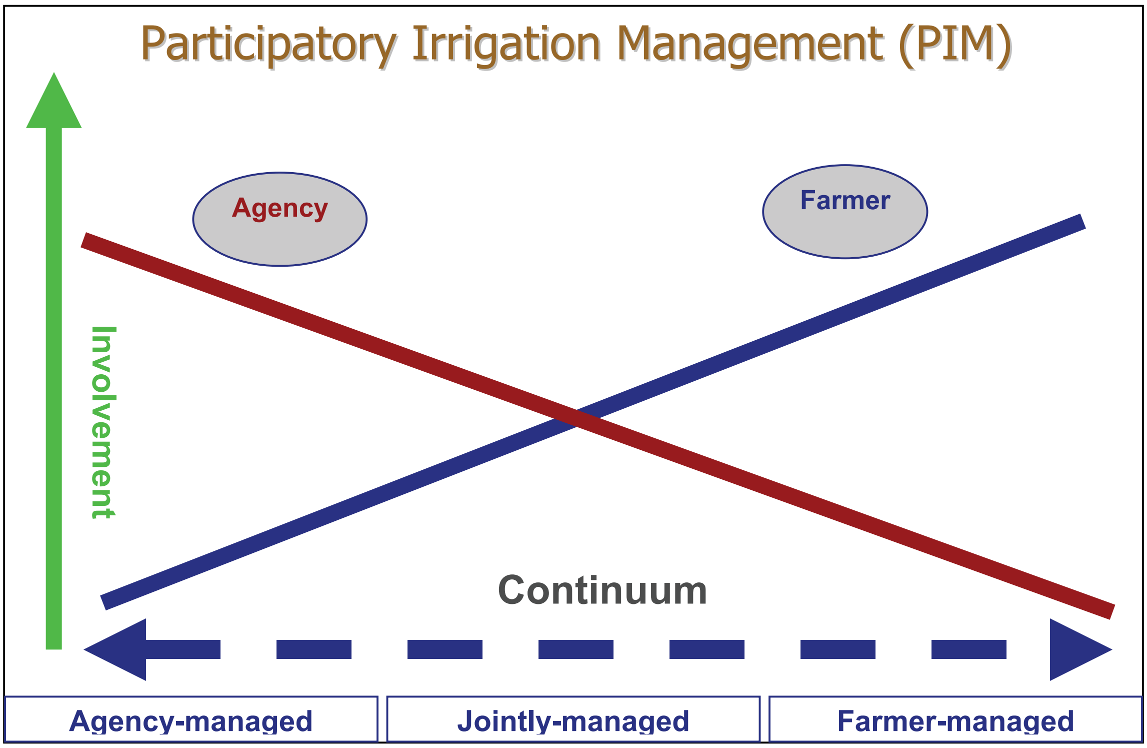


Figure 1. Continuum of Participatory Irrigation Management.

Thus, PIM implies the level, mode, or intensity of user participation that would increase irrigators' responsibility and authority in the management of an irrigation system (http://www.maff.go.jp/inwepf/documents/inaugural/inpim-note.pdf). Hence, the process of initiating PIM clearly is conceivable only in those systems where predominantly the agency has been undertaking various irrigation management activities in the past. Typically, such AMISs or JMISs are originally constructed by the agency without or with some involvement and/or contribution from the farmers. Nevertheless, in cases like East Rapti irrigation systems in Nepal, the management was taken over by the agency, mainly for improving the infrastructure, even though they were originally constructed by the local farmers.

Reviews of various cases indicate that the main aim for initiating PIM is to improve the prevailing disappointing performance levels of the system, both in terms of (Vermillion, 1997; Prasad et al., 1998; Groenfeldt and Svendsen, 2000; Prasad et al., 2000):

- Efficiency of the management process in irrigation service delivery and
- Productive efficiency of resources employed in irrigated agriculture.

Additional rationales behind PIM initiatives – some, particularly inspired by many success stories of FMISs - include the following:

- With PIM, management is decentralized to users in a supportive socio-technical context, which increases the farmers' ownership of the irrigation system;
- PIM provides an opportunity to bring together agencies' nomothetic-, and farmers' idiographic knowledge and experiences for improved management of the irrigation system and thus improved delivery of irrigation services;
- A higher financial and a social cost incurs when only government agencies undertake irrigation management functions;
- Irrigators have stronger incentives to manage water productively than does a government bureaucracy;
- Farmers can respond more quickly to problems or changes in the system leading to increased profitability from irrigated agriculture; and so on.

Nevertheless, PIM related undertakings may have various objectives: e.g. to improve the financial and physical sustainability of irrigation systems (Mexico or Chile): to improve water management and agricultural productivity (Andhra Pradesh, India); to cope with constraints on government budgets (Philippines, Nepal); to delegate control over the irrigation system and improve the water service (Columbia Basin, USA, Australia); etc (Peter, 2004; http://www.fao.org/AG/aGL/aglw/waterinstitutions/default.stm). In addition, it may also be for strategic restructuring of the irrigation sector/agency (South Australia and South Africa) involving downsizing, adoption of new mandates, redeployment of personnel, and a change from a centrally-financed line agency to a financially autonomous authority or corporation (Philippines). Sometimes, irrigators may even pressurize the state to take over the management of irrigation systems to gain control over the use of irrigation service fees and keep the cost of irrigation from rising as in the Coello and Saldaña systems in Colombia and the Dominican Republic.

KEY FEATURES OF PIM

In general, PIM activities are initiated in AMISs (or intensified in JMISs) either under the initiative of the agency or the farmers. The agency's initiative to instigate or intensify PIM related activities, which is often interpreted as 'supply-driven', largely represent an 'intervention' in the *status quo.* In the other case, irrigating farmers approach the agency seeking various financial and technical supports to address various challenges (or threats) in the irrigation system. The agency, in response, may offer various supports in the form of PIM activities with an understanding that irrigators will collectively, through their associations commonly called Water User Associations, (WUAs), assume larger roles in irrigation management activities. The latter is often termed as 'demand-driven'. Such PIM related initiatives are usually based on one or a combination of various rationales mentioned above. Congruent to the latter approach is the process of Irrigation Management Transfer (IMT), which may be initiated with either supply-driven or a demand-driven approach. The last two decades have observed several countries getting increasingly engaged in IMT both in surface and groundwater systems (http://www.fao.org/ag/agl/aglw/waterinstitutions/profiles.stm; Vermillion, 1997; Groenfeldt and Svendsen, 2000). Though generally known as IMT, it is also referred to as: turnover, privatization, post-responsibility system, participatory management, commercialization, self-management, etc in different countries.

Most PIM undertakings have at least two principal sets of activities: a) irrigation system rehabilitation[1] and b) institutional development for improved service delivery. The former set involves activities related to making changes in the infrastructural conditions of the irrigation system. The latter set of activities involves institutional development efforts including the development of farmer organization and related rules and regulations; training and skill development of farmers and personnel associated with irrigation management; establishing links with external support agencies, etc.

Rehabilitation of irrigation systems

As an impetus and means to introduce or intensify PIM, irrigation systems are invariably slated for rehabilitation (and/or modernization). The rehabilitation is meant for make suitable changes in the physical condition of the irrigation system so that the system becomes physically and operationally suitable for PIM related activities. In addition, it is expected that the irrigating farmers, upon assuming greater irrigation management responsibilities, will be able to do so without major technical difficulties. Rehabilitation, which to certain extent determines the eventual success or failure of PIM initiatives, is perceived as an indispensable incentive for farmers to gradually take over the management of the system. In addition to providing an opportunity of working together during the rehabilitation itself, it has often played a major role in inducing farmers' involvement in management process. Nevertheless, the strategies, scopes of work, arrangements for cost sharing and implementation of rehabilitation vary greatly from one case to another (IWMI, 2000; Samad and Vermillion, 2000; http://www.fao.org/ag/agl/aglw/waterinstitutions/profiles.stm; http://www.inpim.org/leftlinks/Documents).

1- Termed differently in different cases (system improvement, modernization, upgrading, revitalization, restoration, etc) depending upon the nature and extent of infrastructure improvement works.

FARMER ORGANIZATION DEVELOPMENT

In parallel to the rehabilitation or even before, formation or strengthening of the WUA as an institution is generally integral to PIM related initiatives. Efforts are made to ensure that the structure of such WUAs matches with the socio-physical hierarchies of canal networks in the irrigation system. An effective WUA (see next section), besides aiding the PIM process, may also determine to a large extent the sustenance of the irrigation system.

With respect to PIM activities, particularly when they are aimed for IMT, devolution of an irrigation management from the agency over to the irrigators represents a form of decentralization. It involves the transfer of authority for decision making for lower-level farmers or groups of farmers in the socio-physical hierarchy of an irrigation system, so that such lower level farmer groups can elect their own councils, raise their own resources, and have independent authority to manage irrigation systems effectively.

Moreover, operationalizing each management activity involves executing three sets of power: legislative, executive and judicial (Agrawal and Ribot, 2000). Each of these three sets of powers involves decision-making. Legislative power allows farmers to form new rules and regulations or modify old ones. Rules to access and use water, distribute to water users, and mobilize/generate resources for system maintenance are important in managing system operation. Executive power allows farmers to implement or enforce the rules as agreed upon, and to monitor whether the rules are actually followed by the users. It also allows farmers to impose sanctions on those who do not follow the rules. Similarly, judicial power allows farmers to adjudicate disputes that arise while enforcing the rules in operating the irrigation system. Thus, empowering WUA as an institution is necessary to promote PIM and devolution of irrigation management authority. Assumption of irrigation management responsibilities only by effective WUAs can result in realization of the PIM objectives. Accordingly, various institutional development and capacity building activities for irrigators and other personnel associated with irrigation management activities are undertaken during PIM initiatives.

What Makes an Effective WUA?

If looked into examples of sustainable and effective WUAs across the world, one may find four key features generally present (Wilkins-Wells and Prasad, 1994; Prasad et al., 2000; Pradhan and Gautam, 2005; Malano and van Hofwegen, 2006). The first is some form of local government for the association, based on the principle of voting and adequate checks and balances in the leadership structure. Such self-governed associations are independent of any local or central government influence other than legal certification and auditing. This is what the autonomy in association governance generally means. The formation of a self-governing leadership structure in the WUA includes the following:

- Defining the hydrological boundary of the command area
- Devising a collectively agreed upon organizational design that fits with the socio-physical hierarchies of canal networks

- Ascertaining the decision-making process and accountability within the organizational framework
- Incorporating provisions for adequate checks and balances/sanctions against defaulters
- Updating the roster of the beneficiaries entitled to receive the irrigation service
- Fixing the eligibility criteria for representation in the association
- Setting out a process to elect/select genuine representatives accountable to the farmers
- Defining the process for modification of organizational set up as and when needed
- Establishing the process to seek and accept various kinds of support from different line agencies
- Resolving the water related disputes between systems, zones of a system or individuals

The second feature is some form of association record keeping, no matter how rudimentary, designed to maintain records on labor mobilization, donations and/or fees, water delivery scheduling, association membership, and some rules about how water is to be managed and divided among beneficiaries during normal and unusual water supply conditions. Typically the record keeping activities involve the following:

- Keeping the ledger and accounts of all sorts of resources mobilized internally or externally for the irrigation system
- Comprehensive accounting of payments and various expenses
- Details of previous water delivery schedules and actual distribution at all levels of the irrigation system
- Details of cropping pattern and calendar in the command area
- Details of entitled water shares, including the utilized and the balance amounts, of individual beneficiaries
- Information regarding collected and due irrigation service fees, based on the rate fixed by the WUA in proportion to water shares
- Keeping track of the violations made by defaulters
- Preparing the budgetary details and financial statements

The third key feature is the presence of an association’s water delivery workforce, however small, appointed and supervised by the association leadership to oversee the management of water and irrigation service delivery in the command area. This workforce is responsible for allocation of water and collection of irrigation fees by shares, meaning that a beneficiary's water right in the association's collective supply is roughly proportional to the contributions made by that same individual to the cost of operating and maintaining the irrigation system annually, in cash, produce, or labor equivalent. Setting up a water delivery workforce includes the following:

- Appointing a core group of people, accountable to the WUA, and mainly responsible for delivering entitled water shares of individual farmers to their fields according to the agreed upon water distribution schedules
- Assessing the duty of available water at different points in the canal system
- Defining a share of water and associated irrigation service fees per share
- Ascertaining water availability in the source and the water use right
- Assessing water demand schedules and patterns
- Suggesting and adopting operational schedules based on demand and supply conditions inclusive of plans of water distribution in different seasons and in situations of water scarcity
- Ascertaining arrangement to distribute any shrinkage in water supply over water shares
- Controlling the free riders
- Documenting details of actual water delivery to the field, time, dates, conveyance time, losses, etc.

The fourth is the mechanism for ensuring adequate maintenance of the irrigation infrastructure. It includes the following:

- Preparing prioritized inventory of required maintenance works
- Estimating resource requirements
- Scheduling maintenance works
- Allocating labors for the works to be done by internal labor mobilization
- Appointing consultants and contractors for specialized works
- Supervising maintenance activities and controlling quality
- Maintaining acquired vehicles and equipments, if any

Besides, a WUA also needs to plan and act for the long term sustenance and efficient productivity of the common pool resource system like irrigation. Therefore, it is necessary for the WUA to be sensitive toward the issues of environmental degradation, deterioration agricultural resource base including the watershed or aquifer. Also, developing linkages with different line agencies and support institutions is important for WUAs' sustained existence and thereby that of PIM.

ACTORS OF PIM

Main actors associated with PIM related activities can be categorized into two groups: a) Responsible actors and b) Contributing actors (**Figure 2**).

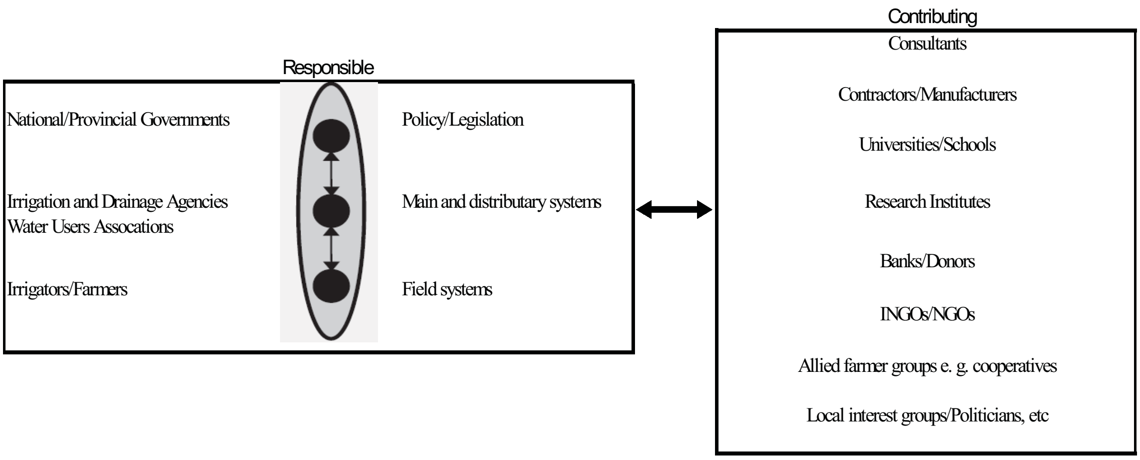


Figure 2. Actors of PIM (adapted from Schultz et al., 2005)

Generally, the responsible actors are: a) national and provincial governments; b) irrigation and drainage agencies or WUAs - which may be appointed by the government, or the irrigators, or jointly; and c) the irrigating farmers. The contributing actors may range from various donors to local politicians and other inertest groups. This implies that to achieve productive and sustainable irrigation system management, the roles of these three actors and their activities associated with irrigated agriculture need to be in synergy. Nevertheless, such a synergy must be accomplished within the legal framework of a country where several rules and regulations will be applicable, such as environmental and land use regulations, ownership, etc (ibid, p. 270-271). The three responsible actors essentially reflect three levels of governance, namely; national and/or provincial; irrigation system level and field level. All other actors only contribute to, or facilitate the effort of effective and sustainable irrigation management. They are needed and have specific functions for various reasons, but ultimately, they are not responsible for the management initiatives in an irrigation system.

Case Review

The 7th conference of International Network on Participatory Irrigation Management (INPIM) pointed out that despite encouraging signs in terms of stabilizing food productions and prices, a wide variation existed in the reported gains from PIM across the world (http://www.maff.go.jp/inwepf/documents/inaugural/inpim-note.pdf). Such variations can naturally be expected, given the diverse socioeconomic and institutional conditions, including the objectives of PIM, in different cases. Nevertheless, some premises encompassing PIM are general as outlined below (Peter, 2004; http://www.fao.org/AG/aGL/aglw/waterinstitutions/default.stm):

- Traditionally, irrigation sector has largely been managed by centralized agencies at the federal/state/province level.
- Most PIM related undertakings have been supported by the major international development banks and many NGOs, often in a time-bound project mode.

- Through PIM, the irrigators are expected to assume larger role in irrigation system management.
- However, irrigation management responsibilities may be shared differently in different cases between and the agency and WUAs. For instance in countries such as France, China, Australia and United States, the regulatory responsibilities rest with the agency while infrastructure control, O&M, service charge collection, etc lie with user-represented companies/boards. In countries such as Thailand, Vietnam, Sri Lanka and Philippines, most of the irrigation management responsibilities lie with the agency but they need to be undertaken with input from the WUA representatives. In Andhra Pradesh (India), Turkey and Albania, these responsibilities are shared between the WUA and the agency with variations in specificities.
- Similarly, organization types that assume greater irrigation management responsibilities through PIM differ. The most common type is WUA, but there are also the irrigation districts which are semi-municipal governments (USA, Mexico and Taiwan). In addition, there are mutual companies where water users own shares in the management company (USA, Mexico and Shandong province in China). WUAs only act as the governing authority and may arrange for contractors to provide water delivery and/or maintenance services (USA and increasingly in China). Self-financing "public" utilities also may take over management from government agencies (Morocco and China).

These premises may significantly define the desirable institutional conditions for PIM on the ground, which may vary from one case to another.

IN-DEPTH CASE STUDY OF NEPAL

Nepal's irrigation policy strongly encourages PIM/IMT in the AMIS and accordingly, the Department of Irrigation (DOI) from 1992 has been engaged in such activities mainly in two forms - joint management and full or partial management transfer to WUAs. The policy embraces both surface and groundwater types of irrigation systems. Irrigation systems irrigating up to 2,000 hectares in the plains and 500 hectares in the hills are to be fully management-transferred to WUAs. Larger schemes would go through a gradual transfer on a priority basis keeping in view the technical requirements of the systems and the institutional capability of the WUAs. Projects such as Second Sector Irrigation Project (SISP, Asian Development Bank supported), Nepal Irrigation Sector Project (NISP, World Bank supported), Irrigation Development Project (IDP, European Union supported), Community Shallow Tube Well Program (World Bank supported), Irrigation Management Transfer Project (IMTP, Asian Development Bank and USAID supported), System Management and Training Program (SMTP) of the DOI itself, and many others such as Marchawar Lift Irrigation Project, Bagmati Irrigation Project, Mahakali Irrigation Project and so on, all emphasize on local management of the irrigation system by the organized irrigators.

By 1998, the DOI had formally transferred the management of three irrigation systems to the respective WUAs: West Gandak (9,000 ha), Panchkanya (406 ha), and Marchawar Lift (2,815 ha) Irrigation Systems. Piparpati and Parsauni minors (1,600 ha) that stand separate from the main West Gandak system, were management-transferred to the WUAs in early 1990s assisted by USAID-supported Irrigation Management Project (IMP). In Kankai Irrigation System, the management of some tertiary canals has been transferred. Similarly, the management of about sixty deep tube wells under Bhairahwa Lumbini Ground Water Project (BLGWP) has also been transferred. All these systems were previously being managed by the DOI and now respective WUAs manage them.

Like most other cases elsewhere, the process of PIM/IMT in Nepal generally incorporates two components: (i) establishment of sustainable and effective WUAs and (ii) rehabilitation and improvement of irrigation and drainage facilities. Establishment of sustainable and effective WUAs also includes the objective strengthening them through various training and capacity building activities so that organized irrigators can successfully assume the irrigation management responsibilities of the physically improved system after the management-transfer. Rehabilitation in generally aimed at upgrading of physical condition of the system to a level that can be managed by the WUAs without technical difficulty and a minimal O&M cost is required after the transfer.

GAINS ACCRUED

Relevant research findings on performance and process of PIM/IMT in Nepal are summarized below (IWMI, 2000). The elaborations are primarily based on 3-year research activities undertaken in Nepal by International Water Management Institute (IWMI) in collaboration with various local partners.

a. Irrigated Agricultural Performance: Agricultural productivity generally showed an increasing trend at PIM/IMT sites. In some schemes, gains in yields are exceptionally higher soon after management transfer. This is likely due to rehabilitation and improved management brought about by PIM/IMT.

b. Resource Mobilization: A comparative performance assessment of resource mobilization practices suggested that the costs of O&M born by farmers are increasing in PIM sites while government allocations for O&M are at low levels following management-transfer. The collections of irrigation services in all PIM sites have improved but the amounts are less than the required regular O&M costs (Sijapati et al., 1998). In general, three kinds of resource mobilization practices are prevalent:

- Labor mobilization for canal maintenance works;
- Cash generation through collection of ISF and other sources; and
- Mobilization of necessary tools and equipment needed for O&M activities.

These resources are mobilized from among the beneficiaries of the system, i.e. internal to the system. The other source of the resources is from outside the system, or external resource mobilization. External resource mobilization might be a contribution from the government or other agencies including non-governmental organizations in the form of a monetary grant for a specific purpose, a regular government contribution for O&M, or a material contribution by the government such as supplying gabion crate boxes or cement for repairing the physical infrastructure.

The resources that each beneficiary must contribute are usually in proportion to the farmer's irrigated area and/or water allocation. The amount of cash or labor per unit of water, which is generally measured in terms of irrigated land, is determined by the general assembly of the irrigators at their annual meetings. Once the contribution rate is agreed upon and approved, the WUA enforces it strictly.

c. Quality of Irrigation Service: Farmer surveys conducted in various irrigation systems indicated that a majority of the irrigators perceived that the adequacy of irrigation water improved with management transfer. Similarly, the timeliness of water delivery became better and water distribution was fairer. In addition, farmers of transferred units faced less difficulty in arranging for irrigation water and felt it easier to get assistance of the WUAs.

c. Maintenance of Irrigation Infrastructure: Surveys indicated that the physical conditions of the irrigation facilities were better after management transfer. Partly this is due to the rehabilitation that preceded the management transfer. The positive perception was more pronounced in the transferred systems than in the non-transferred systems.

The mechanisms of contracting the construction works to farmer representatives had helped WUAs to become more effective but only where the contractor-farmers were accountable to the WUA and full transparency was maintained. Also, WUA's involvement in design aspects was useful in improving the satisfaction level of the irrigators.

d. Farmers' Institution Development: The WUAs formed in course of PIM/IMT are indeed alive, although they vary in effectiveness. Farmers have assumed several irrigation management tasks, either partly or fully. In many places elections are effective in changing leadership when needed. There is evidence that WUAs are learning and improving. However, the WUAs' capacity to enforce their own regulations is questionable in some cases.

Despite these encouraging findings, there remains inconclusive evidence whether the gains can be sustained afterwards (IWMI, 2000). In few cases, other support agencies (contributing actors) in the area were not integrated into the PIM efforts. In addition, some marginal stakeholders such as landless tenants and women were excluded from the institutional development process that took place in the irrigation systems as part of PIM/IMT. Among the key factors to success were found to be the timing of and the importance given to institutional development in the PIM process. Wherever institutional development preceded the rehabilitation, the functional status of WUAs was found reasonably well.

Institutional conditions: opportunities and constraints, Nepal

Moving on the evolutionary path of improving governance in the water sector including irrigation, Nepal has come a long way in decentralizing the related tasks and responsibilities (Neupane and Neupane, 1997; Sijapati and Prasad, 2005). Particularly, after the re-advent of multi-party representation in the government structure in 1990, the process of various stakeholders' involvement in water sector governance (facilitated by institutional changes both in terms of rules and tools) has gained a faster pace. Currently, the organizational structure of water administration in Nepal has three levels:

coordination and policy; implementation and operational; and regulatory. At the level of coordination and policy, the organizations in place are: a) National Development Council; b) National Planning Commission; c) National Water Resources Development Council; d) Water and Energy Commission; and e) Environment Protection Council. Similarly, at the ministry level, six relevant ministries and the Water and Energy Commission Secretariat is involved.

At the implementation and operational level, seven government departments and semi government organizations like Nepal Electricity Authority and Nepal Water Supply Corporation are involved. The local government bodies such as District Development Committees (DDCs), Village Development Committees (VDCs) and Municipalities as well as NGOs like WUAs are also in place at the operational level. The prevalent policy and regulations have entrusted the governance of water at the local level to the WUAs formed by the representatives of the beneficiary. This institution of local organizations with a federation at the central level (e.g. National Federation of WUA, Nepal) is playing an instrumental role at the operational level.

CONCLUSIONS

Recalling back the previously discussed framework of actors PIM, it is evident that at national and regional government level, Nepal has promulgated various laws, policies and organizational structures that are amenable to pursue the policy of PIM/IMT in the AMIS. Similarly, favorable institutional conditions exist both at irrigation system level at which both irrigation agencies and WUAs are actively engaged in PIM/IMT-related activities. Farmers at the field level also are increasingly assuming larger roles in irrigation management tasks. Thus, the institutional linkages among the three governance levels of responsible actors are evident. Nevertheless, their linkages and relationships with the contributing actors with regard to productive and sustainable management of the irrigation systems remain largely obscure and unclear. The experiences so far indicate that the experience of transferring management to farmers has been a giant experiment in Nepal. Overall, the process has been positive, but more needs to be done to achieve the desired objectives in a way that assures sustainability of the gains accrued.

An important element in PIM/IMT process is the farmers' resource mobilization to contribute to recurrent O&M expenses. In the past several attempts have been made to introduce a system to collect water fees from the farmers but without much success or long lasting. Less than 2% of the total O&M expense in the AMIS comes from farmers' contributions and 98% is born by the government. In PIM and IMT sites fee collection rates are better but far from the targeted amount (Sijapati et al., 1998). Therefore, whether gains in irrigated agricultural performance in PIM/IMT sites can be sustained is questionable. In the past, due to insufficient resource allocation for regular maintenance, irrigation systems fell into disrepair soon after rehabilitation and needed to be rehabilitated within a few years. Whether it will be possible to break the cycle of rehabilitation-decline-rehabilitation through sustainable PIM initiatives remains to be seen.

With regard to effective functioning of the WUAs, one difficulty is to locate strong leadership in the community and create an enabling environment for its emergence by creating favorable linkages with contributing actors. This is particularly relevant to the cases in which various supports are extended in the name of supporting PIM/ IMT initiatives through short-lived donor-supported projects such as Irrigation Sector Project, Irrigation Development Project, Community Shallow Tube Well Program, etc. It is also recognized that the WUAs are not “formed” just for the purpose of meeting the condition for implementing rehabilitation without giving much consideration to their long term effectiveness and sustenance.

RECOMMENDATIONS

Refine Goals and Objectives of PIM/IMT: Broadly speaking PIM/IMT in Nepal foresees improvement in agricultural performance and reduction in government expenditure. Though the state has been adopting the policy of PIM/IMT for last several years, clear and measurable objectives are not yet laid out. Instead, transferring the irrigation system over to WUAs in itself is perceived as one of the objectives in contrast to defining the impacts and results that are expected from the management transfer. Defining clearer objectives of management transfer would give a clearer focus to the PIM/IMT effort.

Ensure Sustainability of Gains Accrued through PIM/IMT: Positive impacts of PIM/IMT in Nepal include greater farmer participation in water supply and system management; increased contribution of farmers’ resources to operate and maintain the systems; higher agricultural production; and a more positive farmer perception towards water delivery services. And possibly this all is feasible at reduced recurrent O&M costs born by the state. However, the main threat to these gains is lack of sustainability. To ensure a durable positive impact the state needs to give much more attention towards issues such as:

- Sufficient resource allocation for O&M (be it from farmer contributions or government subsidies).
- Ways to locate good leadership in the community and create an enabling environment for its emergence.
- Focus on institutional development of WUA before rehabilitation. Development milestones, such as WUA registration, certain percentage of service fee collection, etc. as preconditions before starting technical works.
- Post transfer support: DOI should broaden its role of ‘irrigation system manager’ towards ‘support service provider’ – responsible to contributing actor. Such services include providing training to WUA in essential O&M tasks, facilitating access to other services (credit, agricultural extension), and ensuring appropriate legal framework for WUAs to function smoothly.
- More (human and financial) resources allocated to ensure a functional monitoring and evaluation (M&E) system to monitor impacts of PIM/IMT.

More generally, IMT should not be taken as PIM. It is more plausible to see IMT as one of many means for fostering PIM in the management continuum (**Fig 2.**) aimed at improving their performances.

An important area which is sometimes overlooked in the design of IMT programs is the support system for WUAs and irrigated agriculture during and after management transfer. Clear roles of responsible and contributing actors at state/national, provincial are often obscure. Planners need to consult with water users about what support services are most needed by the farming community in order to assume the new responsibilities and tasks as well to overcome constraints and to explore new income opportunities. Support services during and after management transfer may include advisory services about institutional arrangements for the WUA, establishment of organizational and financial procedures and skills, credit facilities, legal advice, marketing and construction procedures. Training and extension will be an important tool to develop the knowledge and skills of farmers and enable WUA officials to undertake management responsibilities and ensure more profitable irrigated agriculture.

REFERENCES

1- Agrawal, A and J.C. Ribot. 2000. "Analyzing Decentralization: A Framework with South Asian and West African Environmental Cases." Working Paper. World Resource Institute.

2- Groenfeldt, D and Mark Svendsen (eds). 2000, Case studies in participatory irrigation management. WBI Learning Resources Series: TC812.C37. The World Bank Institute, Washington DC.

3- IWMI, 2000. Evaluation of Management Transfer Performance and Process, Nepal. Project Completion Report. (September 1996 – April 2000). May 2000. International Water Management Institute, P. O. Box 2075, Colombo, Sri Lanka.

4- Malano, H. and P. van Hofwegen, 2006. Management of Irrigation and Drainage Systems: A Service Approach. IHE Monograph 3. UNESCO-IHE, Delft, Netherlands.

5- Neupane, I. and Neupane, B. 1997. Institutional Framework to Support Management Transfer. In workshop proceedings: Evaluation of Irrigation Management Transfer Process and Performance - Workshop held in Kathmandu, 5-6 October 1997. Neupane, I.; Prasad, K. C. (Eds.) 1997. Proceedings of workshop jointly organized by Research and Technology Development Branch (RTDB) and IIMI. 139p. + annexes.

6- Peter, Raymond J., 2004. Participatory Irrigation Management. INWEPF/SY/2004(06). Pp 13. http://www.maff.go.jp/inwepf/documents/iaugural/inpim-note.pdf.

7- Pradhan P. and U. Gautam, 2005. Farmer Managed Irrigation Systems and Governance Alternatives. Proceedings of the Third International Seminar, 9-10 Sep 2004, Kathmandu, Nepal. FMIS Promotion Trust, Nepal.

8- Prasad, K., Thoreson, Bryan P., and David J. Molden. June 2000. Tracing the History of the Development and Management of Two Irrigation Systems in the Terai of Nepal. In proceedings of the International Conference on "The Challenges Facing Irrigation and Drainage in the New Millennium", June 20-24, 2000. Fort Collins, Colorado, USA.

9- Prasad, Krishna C., Sijapati, S., Pradhan, P., Sharma, K. R. and Nicola Riddel, 1998. Irrigation Service Fees in Nepal. IIMI and Research and Technology development Branch/DoI, Kathmandu, Nepal.

10- Schultz, B; Thatte, C. D.; and V. K. Labhsetwar; 2005. Irrigation and Drainage: Main Contributors to Global Food Production. Irrigation and Drainage 54: 263–278 (2005). Published online in Wiley InterScience (www.interscience.wiley.com). DOI: 10.1002/ird.170.

11- Sijapati, S., Prasad, K. C., and W. R. Laitos, 1998. Resource Mobilization for Participatory Irrigation Management. In proceedings of the INPIM Seminar held during 10-14 Nov 1998, IAAS, Chitwan, Nepal.

12- Sijapati, S. and Krishna C. Prasad, 2005. Improving governance in Nepal's water resources sector through institutional changes. In proceedings of Third International Conference of USCID, March 29-April 2, 2005, San Diego, USA. Pp. 141-151.

13- Wilkins Wells, John and Krishna C. Prasad, September 1994. The Role of Rural Credit Institutions in Irrigation Management Transfer. In proceedings of the "International Conference on Irrigation Management Transfer", September 20-24, 1994, Wuhan, P. R. China.

14- Vermillion, D. L. 1997. Impacts of irrigation management transfer: A review of the evidence. Research Report 11. Colombo, Sri Lanka: International Irrigation Management Institute.

BUILDING CAPACITY FOR PARTICIPATORY IRRIGATION MANAGEMENT - EXPERIENCES AND EMERGING ISSUES

Tom Franks[1]

ABSTRACT

This paper builds on established concepts of capacity-building to look in turn at the key dimensions of the policy environment, institutional strengthening and individual development. The importance of a consistent and supportive policy environment for building capacity for participatory irrigation management (PIM) is emphasised. A range of approaches to institutional strengthening are put forward, and their focus on the strengthening and development of Water Users Associations for PIM is discussed. Individual development is normally undertaken through training, but there is a clear need for innovatory and non-formal approaches to training, particularly to support PIM.

The paper then goes on to discuss water governance and social learning, as two key emerging issues of particular relevance to capacity-building for PIM. Water governance provides a framework for viewing PIM within the wider perspective of the water sector as a whole, while the current emphasis on social learning is particular relevant to concepts of participation and PIM, and provides an entry point for capacity-building through individual development.

Recent experiences collated through ICID workshops and elsewhere are reviewed for insights into capacity-building for PIM. These include experiences from India, China, Peru, and transition economies such as Ukraine and Albania, with reflective case studies from Pakistan, Bangladesh, Nigeria and Tanzania.

The paper draws on these experiences to develop some general conclusions in the light of the theory and concepts of capacity-building, in particular highlighting the need to take an integrated view of all the resources needed for capacity-building for effective PIM and the importance of better understanding of participatory processes and of learning at the local level.

1- Chair, ICID Working Group on Capacity-Building, Training and Education tel 44-1274-235272, tom.franks@btinternet.com

INTRODUCTION

Capacity-building is now recognised as an essential component of policies, programs and projects for development. It is realised that scientific and technological advances must be accompanied by matching increases in the capacity of individuals and organisations to manage technology if overall improvements are to be made. This is particularly the case in participatory irrigation management (PIM) and other areas of agricultural water management, which bring together a complex mix of biophysical, economic and social factors, encompassing a range of actors.

A range of definitions of capacity-building are available. A useful definition is given by UNDP, which has done a considerable amount of work in this area:

> 'the process by which individuals, groups, organisations and societies increase their abilities to perform core functions, solve problems, achieve objectives and to understand and deal with their development needs in a broad context and a sustainable manner' (UNDP 1998).

This definition focuses on capacity-building as a process and highlights that it is needed not only to support individuals and organisations in their day-to-day operations (core functions) but also in taking a strategic view (developmental needs and objectives). It therefore encompasses a range of concerns, at the large and local scale and in the long and short term. There is an extensive literature by a variety of development institutions and international agencies on approaches to capacity-building which address these range of concerns (see for example (Fukuda-Parr, C et al. 2002).

A consensus emerges from this body of work on a basic theoretical concept for capacity-building. This concept has been taken up by ICID in the recent work carried out through the Working Group on Capacity-Building, Training and Education (http://www.wg-cbte.icidonline.org/home.html) and forms the framework for this paper in consideration of capacity-building needs for PIM. The concept identifies capacity-building needs at three levels, at the level of policy, at the level of the organisation or institution, and at the level of the individual.

This paper describes the context for PIM and elaborates the conceptual framework within which to consider capacity-building for PIM. It then addresses in more detail certain key issues which have arisen recently in this field, before going on to review the experiences in capacity-building brought together within ICID and other fora over the past few years.

THE CONTEXT FOR PIM

Over the past two decades dissatisfaction with public sector management of irrigation has grown as a result of constraints on government effectiveness and financing and of ideas of 'rolling back' the role of the state from that of service provider to that of regulator. This has particular resonance in the irrigation sector, in which beneficiaries are often relatively well off compared to others in the agricultural sector. This suggests that private sector structures may be more appropriate than traditional public organisations in providing services to irrigation farmers, in turn leading to the idea of transferring responsibility for management to beneficiaries through some form of irrigation management transfer (IMT).

IMT requires that there are institutions ready and capable of taking over some of the management responsibilities. Such may indeed be the situation in richer countries with a long history of private sector development, in which private sector institutions may have the capability and experience to take on management roles and where formal legal relationships are well understood and developed. In many other poorer countries, including many of those with extensive surface irrigation systems, institutional structures are not developed in this way, there are few institutions with the management expertise to take up the new roles under IMT, and formal legal relationships are ill-defined and difficult to exercise. In such situations it is necessary to build on existing institutional structures and find innovative ways of bringing farmers together to assume management responsibilities. Almost inevitably this requires some form of PIM, implying 'participation' between farmers who, in other respects, may not necessarily be accustomed to participation with one another, or who would prefer for other reasons to participate in different structures and groups from those reflecting the hydraulic system. Most often participation is expected to take place through some form of Water User Association (WUA) which takes over some of the managerial roles and responsibilities of the public irrigation agency. Inevitably, therefore, much of the focus of capacity-building for PIM lies in developing or strengthening WUAs and the participatory processes which underlie them.

THE POLICY ENVIRONMENT

It has long been recognised that a supportive policy environment is essential if efforts to increase capacity at the local level are to be successful. In the case of PIM, the key policy measures have been identified above, a policy of transfer of management responsibility for irrigation (IMT) away from the public sector to an appropriate private or non-governmental organisation, and, where the private sector is not yet in a position to take the responsibility, a policy of participation in irrigation management (PIM) through a WUA. These two form the essential components of a capacity-building strategy for the sector.

However there is also a clear need in capacity-building to ensure that other subsidiary policies are in place to support overall policy aims and directions. For example, there are often regulations concerning the establishment of participatory organisations which involve heavy transaction costs (visits to central ministries and departments, payment of significant fees) and which may result in constraints and hindrances to their effective functioning. Another aspect of supporting policy which must be considered is the relationship between hydraulic organisations such as WUAs and the structures of local government, particularly in contexts where hydraulic systems form the dominant element of the local landscape. In such situations the overall policy environment may actually be hostile to the establishment of powerful and effective grass-roots irrigation organisations because of their significant political importance at this level, even if the avowed policy aim in the agricultural sector is management transfer to participatory management organisations (Theesfeld 2004).

INSTITUTIONAL STRENGTHENING

Institutional strengthening forms the next level of capacity-building. The concept of institutions needs some definition here, since it has two distinct but related meanings. Institutions refer, firstly, to the rules and norms which govern the way people live and interact with one another. Thus reference is made to the institutions of the law, such as property rights, and the institutions of personal relationships, such as those set by marriage or kinship. Such institutions result from a range of formal and socially-constructed forces in society (politics, legislation, culture, tradition, wealth and so on). They change and develop over a long periods and, whilst their importance in capacity-building is widely acknowledged, it is also recognised that it is difficult to make significant changes over the short-term of development interventions. The second meaning of institutions is in relation to organisations, deliberately or informally constructed groupings which may range from bureaucratic structures with established constitutions and defined roles to loosely-aligned groups of individuals and households. Institutions in this sense refer to the Law Courts (the arrangement of judges and other legal officers, together with their buildings and operational systems) or the grouping of individuals within family household or kinship structures. Much of the challenge of capacity-building lies at the institutional level.

Part of the challenge arises from the dual nature of 'institutions'. That element of institutions relating to rules and norms arises over the long-term as a result of interactions between individuals in close groups, in the wider environment of organisations and in the context of society as a whole. Rules and norms are dynamic and change over time, but they change as a result of the interaction of a range of different trends, forces and pressures, and they are seldom susceptible to change as a result of a single development intervention or even a programme. For example, attitudes towards co-operation and participation will be determined by a range of factors in the local context and in society as a whole, and they will not change significantly over the long-term solely as a result of a project designed to foster participation. The other aspect of institutions, the groupings and organisations which provide roles for the individuals within them, are more amenable to purposive change through projects and other interventions. Here again, however, a note of caution must be sounded as organisations consist of both structure and culture. The structure (the relationship of roles) is possible to define, develop and modify. The culture (the way of doing things in the organisation) bears many resemblances to the rules and norms of institutions. It develops slowly over time and can be changed only incrementally and in a loosely-defined way.

With this note of warning, there are nevertheless some approaches which can be used as a basis for approaches to institutional strengthening within capacity-building. For example Ostrom has been working on issues of self-governing institutions for irrigation over the past 20 years. Whilst her interest lies in governing the resource commons in general, her focus on irrigation as a case study makes her work particularly relevant for PIM. Initially postulated as a set of design principles (Ostrom 1991), more recently the ideas have been recast as a set of questions to be asked when designing or strengthening institutions for resource management (Ostrom 2005). With specific reference to PIM at the local level, they can be translated as:

- How can the boundaries of the system and the people using it be defined, so as to make clear who is authorised to benefit?

- How can the relationship between benefits received and costs contributed be defined?
- How can the participation of those involved in making key decisions be supported and encouraged?
- Who is monitoring the operation of the system, and do they have appropriate incentives for this task?
- What system of sanctions is in place for infringement of rules and are these appropriate and appropriately graded?
- What mechanisms exist to solve conflicts over water use?

There has been considerable discussion and comment on these design questions, on a number of counts. For example, it is suggested that they do not sufficiently take into account the variability and dynamism of the contexts in which they are applied, nor the socially-constructed understandings that shape peoples' collective action (Cleaver and Franks 2005). For example, people have may have a wide range of reasons for interacting with one another, such as kinship, so that their relationships are not wholly mediated by the fact that they are members of the same WUA. Thus the simplicity of the concepts underlying the design questions may mask a range of complex inter-relationships which will have an important bearing on the way that institutions for PIM develop. Nevertheless the Ostrom questions provide a useful entry point into thinking about the necessary conditions for long-lasting institutions for PIM.

A second entry point to institutional strengthening arises from approaches commonly applied to organisations across the spectrum of management concerns. These have been codified for development organisations into a number of questions (DFID 2003):

- Is there a strategic plan for the organisation? How does the strategy relate to the organisation's mandate and responsibilities?
- What is the formal structure of the organisation? How is decision-making exercised and what are the mechanisms for accountability?
- What is the organisation's culture? How are its rules and norms established?
- What inputs and resources are available to the organisation? What systems and processes are in place to define the organisational system? What outputs and performance result from this?

Questions arising both from the Ostrom principles and from management approaches more generally put great emphasis on the formal structures of institutions, and highlight concepts such as transparency and accountability. They provide much less guidance in dealing with the informal and unstructured aspects of institutions, the way people do things in an organisation, and how these rules and norms have developed. In additional a whole range of issues and questions are raised by the nature of participation, which are reflected by the wealth of development literature about its problems and pitfalls. These arise from inter-related strands of debate about the various types of participation. So, for example Khanya defines participatory relationships ranging from self-mobilisation at one extreme (in which people participate by taking initiatives independently of external institutions for resources and technical advice they need, but retain control over how resources are used) to manipulative participation at the other extreme (in which participation is simply pretence, with representation on official boards by people who are not elected and who have no power) (Khanya 2002). Issues of power and power relationships underlay key discussions about participation, leading us to ideas about the 'tyranny' of participation and about modes, methods and outcomes of participation within a single group or organisation. This in turn raises questions concerning the position of individuals within participatory groups such as WUAs. Who participates and why? What are the outcomes for different people within the group or organisation? How can we strengthen participatory organisations such as WUAs whilst at the same time allowing for the important differences that underlay the contribution and commitment of people within the association.

In considering capacity-building for PIM, it must be recognised that there is no universal theory underlying institutional strengthening. It is therefore inevitable that any approach to institution building must work not from theories but from a range of questions or issues which need to be addressed. The answers to these questions will vary from location to location, and indeed will change over time. Moreover the process of answering these questions must emerge through a participatory process, if long-lasting participative institutions are to result. This process needs to pass through the stages of:

- diagnosis (assessing the present situation)
- design (proposing changes and improvements for the future)
- implementation (initiating and establishing the proposed changes)
- evaluation (assessing outcomes and identifying the need for further modifications).

If truly effective participatory structures are to emerge, there will be need for further consultation and participation at every stage of this process. Overall, therefore, it may become very lengthy, and required sustained effort and support over considerable time. The need for such sustained intervention is constantly stressed in the development literature (Toner and Franks 2006): frequently it requires considerably more time than that for the development or upgrading of the accompanying physical systems.

INDIVIDUAL DEVELOPMENT

Individual development forms the third level of capacity-building. The capabilities of individuals are essential to the effective operation of systems and organisations and there has therefore been considerable emphasis in the past on developing capabilities through programmes of training and extension. There have been significant successes in training programmes, both for the personal development of individuals and also in making them more effective in their organisational roles. However it is also widely acknowledged that training initiatives are often a default option for capacity-building programmes, since they are relatively easy to deliver and evaluate. Increases in individual capabilities can be demonstrated to be value for money, without having to address the more difficult question of whether they in turn contribute to an overall increase of capacity at the institutional level. Training and extension to support PIM is vitally important and the approaches to successful training are now well understood.

A significant feature of modern approaches to individual development is the increasing emphasis being put on non-formal methods and approaches. Whereas in the past the most common option was to work through a programme of formal classroom-based training, it is now recognised that other methods may be more appropriate and effective. This include ideas such as twinning, where individuals exchange visits with others in similar organisations to see how problems can be addressed in different ways, and networking, where individuals share experiences with groups of others to address common problems. Advances in IT have made possible forms of twinning and networking which would have been impossible a few years ago because of the constraints of communication and distance.

EMERGING ISSUES

Whilst ideas of capacity-building have been with us for some considerable time, the water sector has seen emerging in recent times some new and innovative concepts which can enrich and broaden the range of available approaches. This paper will focus on two of these in particular, concepts of water governance and ideas of social learning.

Water governance is gaining increasing attention in the international consensus on water policy. Defined as “the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society” (Rogers and Hall 2003), good water governance implies finding appropriate structures for water management which bring into play the different sectors and groups in society, such as government, the public sector, the private sector, together with citizens’ groups and NGOs which will come together through some form of participation. It thus has particular resonance with the ideas of PIM, since it suggests the need to look for structures and processes which work alongside more traditional bureaucratic systems. Recent proposals for a framework for water governance (figure 1) link available resources to mechanisms for access to water, leading in turn to outcomes for people and the ecosystem (Franks and Cleaver 2007). This framework suggests a complementary perspective from which to view capacity-building needs, by stressing the importance of understanding how people draw on a diverse range of resources (institutional, social, rights, economic, human, technological and natural) to support their access to water

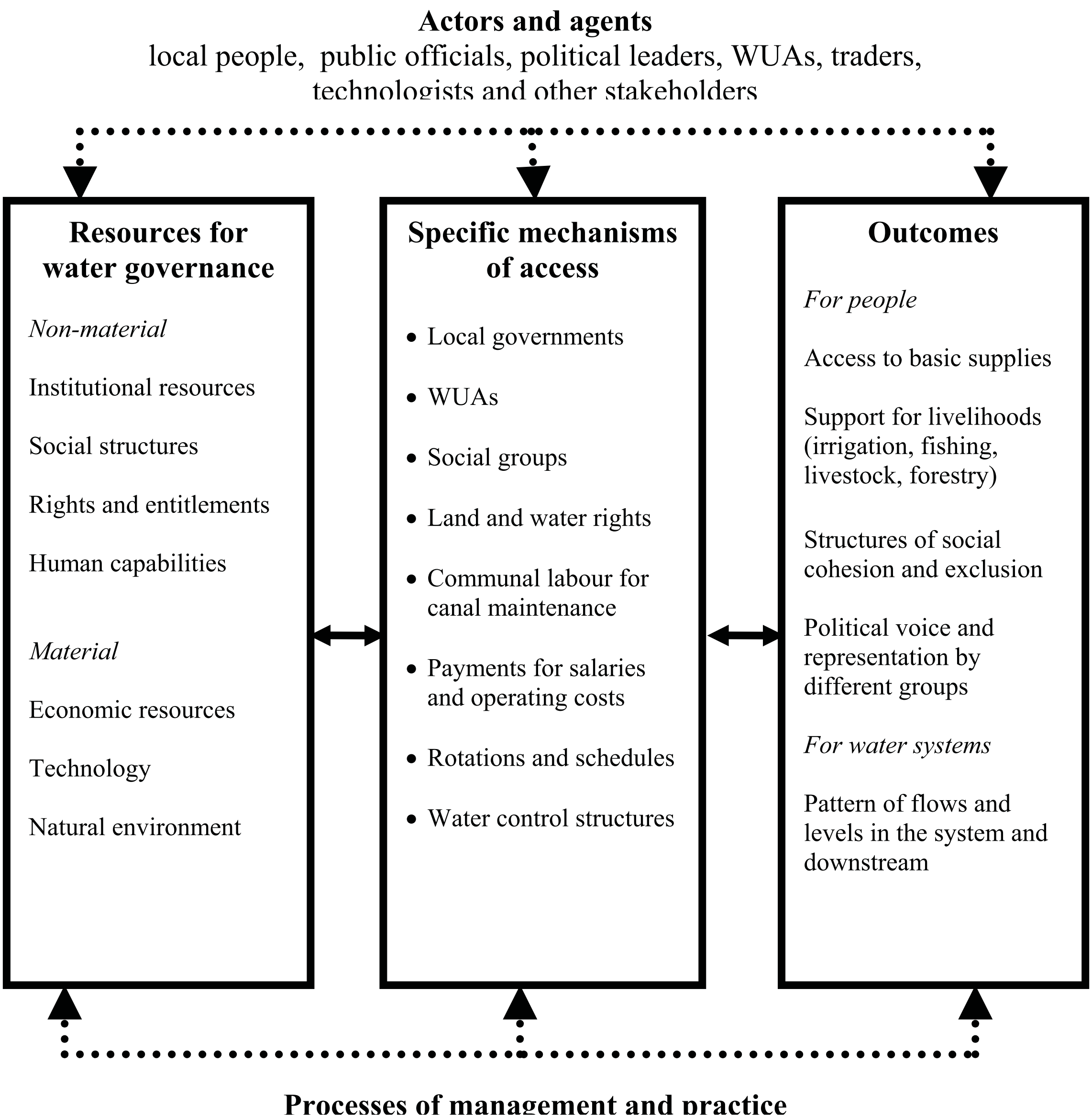


Figure 1. A Framework for Water Governance

A further development of relevance to capacity-building for PIM has been the recent focus on ideas of social learning. Social learning refers to individual learning based on observation of others and their social interactions within a group and has found wide applicability in a range of social and technical contexts. It has only recently come to be applied to water management, but finds particular resonance when applied to ideas of PIM. Specifically it emphasises collaborative and participative learning by individuals within the institutions responsible for PIM, rather than top-down, hierarchical learning which will not be fully owned by the farmer and farmer organisations at the local level. Social learning was the topic for a special session at the Fourth World Water Forum (www.wg-cbte.icidonline.org/ft4_20_report.pdf). In its findings this session emphasised the need for broad partnerships among stakeholders to reach out and involve as many people as possible in the capacity development process, and for mechanisms to allow these stakeholders to work together and learn from each other.

EXPERIENCES TO DATE

ICID's Working Group on Capacity-Building, Training and Education has been researching issues of capacity-building over a considerable period. Most recently this has been through a series of workshops, mainly co-sponsored and funded through IPTRID, which have studied the whole cycle of capacity-building. Thus, starting in 2003, there was an opening event which set out the basic concepts of capacity-building, as presented in the preceding sections, and brought together an initial series of case studies (ICID and FAO 2004). This was followed in 2004 by a workshop in Moscow which focussed on the approaches and methods of capacity needs assessment, and then in 2005 by the Beijing workshop which highlighted the design and implementation of capacity development strategies. The final workshop in the series, in Kuala Lumpur in 2006, considered approaches to monitoring and evaluation of capacity-building. This brought together some very interesting case studies but, not surprisingly, it was the area where there was least experience. This reflects the fact that M&E is more talked about than practised (very few sponsors or financing institutions are actually willing to put time and resources into M&E, in spite of the theoretical importance it is given), and also by the fact that it is intrinsically very difficult to monitor and evaluate the outcomes of capacity building initiatives, except in relation to the specific output of training programmes (numbers of people trained, in which topics).

The workshops brought together experiences over the whole spectrum of capacity-building. These included capacity-building for PIM, and a brief reference is made here to the key papers and presentations relevant to this field. In the main these experiences related to capacity building for Water User Associations (WUAs), with the generally unspoken assumption that WUAs are an essential component of IMT and PIM, since it is actually WUAs which will need to take up the functions of management transferred from the public sector.

An important set of experiences arises from the Andhra Pradesh Farmer Management of Irrigation Systems (APFMIS) legislation of 1997 (Peter 2003). This was a very large scale undertaking to transfer responsibility for management in the state, involving the establishment of over 10,000 WUAs. Peter's main emphasis is on the creation of farmer networks to support the overall process of capacity building but importance was also given to exchange visits and study tours, and to an effective communication strategy using information technology and other media. Throughout the process there was an emphasis on empowering WUAs and providing continued support after their establishment. Training formed an important part of the process but more significant inputs came through other formal and informal means of institutional strengthening and individual development. Complementary experience of capacity building in the Andhra Pradesh Farmer Managed Groundwater Systems project (APFAMGS) is described by Rao et al (Rao, Das et al. 2006). Capacity building for this large-scale project was carried out using a variety of methods comprising cultural shows, training, workshops and visits. A key component of the process in this case was farmer field schools, relying extensively on non-formal education methodology. (The need for developing non-formal education methodologies is also explored in the paper by Botha on South

African experience (Botha 2005), though Botha's paper does not directly deal with PIM).

Fuqiang and Heping explored issues of large-scale capacity-building for WUAs in their review of experiences of China (Fuqiang and Heping 2006). This review emphasises the importance of an appropriate policy environment. They note in particular that the level of water fees was set so low that most of the fees collected went towards buying bulk water from the irrigation district agency, thus leaving little for supporting the day-to-day activities and operation of the WUAs. They also note that developing participatory systems is difficult in contexts where there was a highly centralised system of control, resulting in very little autonomy for the newly-formed WUAs and a corresponding lack of performance incentive for the managers (a point emphasised in the Ostrom design questions).

Other regions of the world which have also experienced transitions from a centrally-planned economy have met similar difficulties in building authentic capacity for PIM. Van Scheltinga and Zovtonog described the approach on the Watermuk project in Ukraine, involving the setting up of WUAs in a situation where previously there had been strong centralised control (VanScheltinga and Zovtonog 2004). Here, too, use was made of the concept of study tours and exchange visits, to complement formal training and to introduce the officials and participants to contexts in which such organisation can function effectively. Dedja provides an interesting review of the experience in Albania, including the transition from village-based to hydraulic-based WUAs (Dedja 2003), to reflect a more rational boundary for co-operation and participation. Dedja emphasised the importance of technical assistance and training particularly in financial management, to ensure the financial sustainability of the associations. This experience is mirrored in other sectors and in other regions around the world.

Ledesma (Ledesma 2003) described a programme to change long-established institutional arrangements for irrigation management in Peru. An international NGO was invited in to lead a comprehensive programme of institutional change, mainly through a programme of participatory training focussing on changes in knowledge, skills and attitudes, both for irrigation agency officials and for some 64 user boards. The training and capacity-building was directed towards encouraging the user boards to take on full responsibility for local water management, including the collection of fees from farmers and to encourage private funding for irrigation. ICID engaged with the issues of social learning, with the paper by Mati presented at the Beijing Workshop. Whilst emphasising the importance of approaches such as the establishment of farmer networks and exchange visits, Mati and her colleagues put stress on the value of identifying farmer innovators who can be supported as champions of change at the local level (Mati 2005).

Ideas of water governance and participation lead to a complementary set of considerations for institutional strengthening of PIM. In a recent survey practitioners were invited to develop reflective case studies from their field experience, in which they reflected on the mechanisms which people use to support or enhance their access to water, many of which are in context which imply some form of participatory management. Thus Hill working in Bihar notes the need for sustained support for newly-formed WUAs and also the crucial importance of financial sustainability and some form of financial saving or contribution to pay operation costs (Hill 2006). The need of financial sustainability has been noted by many other commentators, both within the irrigation sector (for example in Bangladesh by Smith et al (Smith 2005)and outside it, in Uchira, Tanzania by Toner (2006) and in NWFP, Pakistan by Tod (2004). Lessons from Africa likewise confirm the potential advantages but also some of the pitfalls of assuming that PIM will operate effectively. In SW Tanzania, for example, the costs of collecting water rates from a number of widely-distributed small farmer organisations far outweighed the revenue collected, thus leaving the Water Office worse off than if no fees had been collected (Lankford 2005). In Nigeria Bdliya notes the importance of a wide-ranging stakeholder analysis to correctly identify the locus of power and influence surrounding irrigation systems (Bdliya 2006). In that particular case, traditional (non-bureaucratic) structures are far more important than government agencies and bureaucracies because they lie closer to the system and because they form part of the daily fabric of peoples' lives, rather than being connected with only one part of it, the allocation and use of water. In such a context, any form of PIM must work in harmony with existing institutional structures if it is to be successful.

CONCLUSION

This paper analysed the need for capacity building for PIM at the level of the policy environment, institutional strengthening and individual development. It discussed the importance and relevance of the emerging concepts of water governance and social learning to capacity-building for PIM. Finally it reviewed the experience of ICID and others in the field.

From the field experiences a consensus seems to emerge on the need for:

- understanding existing institutional and social structures
- sustaining support for institutional strengthening
- building the financial sustainability of local institutions
- identifying local champions for change

In general, institutional strengthening provides the most significant issues in capacity-building, and there is no blueprint for success. The article outlined approaches to institutional strengthening which build on a set of design questions. The appropriate responses to these questions will vary from location to location.

The emerging concepts of water governance and social learning suggest further key challenges for capacity-building. These include the need to:

- take a broad and holistic view of institutional strengthening, viewing it not just as establishing the form and structure of appropriate organisations but rather as working across the range of resources for water governance.
- understand better how participation works in different situations, and how it can be supported by individual learning in a social context.

Whilst much has already been learnt from field experiences, there will always be a need for further learning as the needs for capacity-building change in the constantly evolving context of PIM.

REFERENCES

1. Bdliya, H. (2006). Institutional Failures in the Management of Critical Water Resources in the Komadugu-Yobe Basin. Workshop Proceedings, Water Governance - New Perspectives and Directions, Bradford Centre for International Development (http://splash.bradford.ac.uk/files/PDF%20Hassan%20Bdliya%20seminar%205.pdf).
2. Botha, M. (2005). Design and Implementation of capacity development Strategies: A South African case Study. Workshop Proceedings on Design and Implementation of Capacity Development Strategies IPTRID, Rome.
3. Cleaver, F. D. and T. R. Franks (2005). How Institutions Elude Design: River Basin Management and Sustainable Livelihoods. BCID research paper 12, www.bradford.ac.uk/acad/bcid/research/papers/ResearchPaper12CleaverFranks.pdf.
4. Dedja, Y. (2003). Capacity-Building for Water User Associations in Albania. FAO Water Report no. 26.
5. DFID (2003). Promoting Institutional and Organisational Development, Department for International Development, London.
6. Franks, T. R. and F. D. Cleaver (2007). Water Governance and Poverty: A Framework for Analysis. Progress in Development Studies in press.
7. Fukuda-Parr, s., L. C, et al. (2002). Capacity for Development: New Solutions to Old Problems. , Earthscan/UNDP.
8. Fuqiang, T. and H. Heping (2006). A General Review of the Capacity Development for Agricultural Water management in China. Workshop Proceedings on Design and Implementation of Capacity Development Strategies IPTRID, Rome.
9. Hill, J. (2006). The Poverty of Water Governance: The Case of a Hamlet in Jahrkand. Workshop Proceedings, Water Governance - New Perspectives and Directions Bradford Centre for International Development (http://splash.bradford.ac.uk/files/PDF%20Joe%20Hill%20seminar%205.pdf).
10. ICID and FAO (2004). Capacity Development in Irrigation and Drainage: Issues, Challenges and the Way Ahead, FAO Water Report no. 26.
11. Khanya (2002). Guidelines for Community Participation in Loncal Governance in South Africa. Khanya-AICDD www.khanya-aicdd.co.za.
12. Lankford, B. (2005). Rural infrastructure to contribute to African agricultural development: the case for irrigation. Report for the Commission for Africa, ODG, University of East Anglia.
13. Ledesma, A. (2003). Institutional Strengthening of the User Organisations in the Peruvian Coatsal valleys. FAO Water Report no. 26.

14. Mati, B. M. (2005). Capacity-Development Strategies: Lessons from Promoting Farmer Innovation (P.F.I) in East Africa. Workshop Proceedings on Design and Implementation of Capacity Development Strategies IPTRID, Rome.

15. Ostrom, E. (1991). Governing the Commons: the Evolution of Institutions for Effective Action., Cambridge University Press.

16. Ostrom, E. (2005). Understanding Institutional Diversity, Princeton University Press, Princeton and Oxford.

17. Peter, J. R. (2003). Capacity-Building for Participatory Irrigation Management: The Case for Andhra Pradesh. FAO Water Report no. 26.

18. Rao, S. P., G. Das, et al. (2006). Monitoring and Evaluation of Capacity Development Programme as Part of APFAMGS Project, India. Workshop on Monitoring and Evaluation of Capacity Development Strategies ICID/IPTRID, Kuala Lumpur.

19. Rogers, P. and A. Hall (2003). Effective Water Governance. TEC Background Papers no. 7, Global Water Partnership.

20. Smith, L. (2005). Practitioner Reflective Case Study no. 21. Water Governance and Poverty Project http://splash.bradford.ac.uk/files/PDF%20Practitioner%20Input%20Form%2021.pdf.

21. Theesfeld, I. (2004). Constraints on collective action in a transitional economy: the case of Bulgaria's irrigation sector. World Development 32(2): 251-271.

22. Tod I. (2005). Practitioner Reflective Case Study no. 12. Water Governance and Poverty Project http://splash.bradford.ac.uk/files/PDF%20Practitioner%20Input%20Form%2012.pdf

23. Toner, A. L. (2006). Democratising Access of Localising Inequality: The Evolution of a Community-managed Water Supply in Uchira. Workshop Proceedings, Water Governance - New Perspectives and Directions Bradford Centre for International Development (http://splash.bradford.ac.uk/files/PDF%20Anna%20Toner%20seminar%205.pdf)

24. Toner, A. L. and T. R. Franks (2006). Putting Livelihoods Thinking into Practice: Implications for Development Management. Public Administration and Development 26: 81-92.

25. UNDP (1998). Capacity Assessment and Development in a Systems and Strategic Management Context., United Nations Development Programme, New York.

26. VanScheltinga, C. T. and O. Zovtonog (2004). Changes in Irrigation Water Management: the Need for Capacity Development in Ukraine. Workshop Proceedings on Capacity Development in Agricultural Water Management IPTRID, Rome.

PARTICIPATORY TRAINING PROGRAMME IN CANAL IRRIGATION IN ANDHRA PRADESH, SOUTH INDIA

R. Doraiswamy[1]

ABSTRACT

This paper deals on the field activity of participatory training programme (PTP)/capacity building of various stakeholders undertaken by JalaSpandana in large canal irrigation projects namely Kurnool Cuddapah Canal, Rajolibanda Diversion Scheme and Priyadharshini Jurala Project in Andhra Pradesh (AP). The objectives are to strengthen PIM, sustain WUAs, enhance water use efficiency and livelihoods, etc. JalaSpandana designed Participatory Training Programme (PTP), which build the confidence of farmers and other stake holders and produced good results in taking over the responsibility of collecting water tax/rates/charges, exploring alternates for efficient main system management, sustainable WUAs, tail end deprivation, etc. The design adopted approach to involve users and other stakeholders in the process of preparation, implementation and impact assessment of training modules. Further, the trainings were carried out in an integrated approach to Integrated Water Resources Management with unlimited time bound programmes that is easy to encompass all the complexities of the irrigation system, which again could be registered by the participants. In AP, PTP is supported by Irrigation and Command Area Development, Government of Andhra Pradesh. PTP is extended to irrigation projects that are undergoing modernisation programme with huge expenditure. Establishing model farms and WUAs are fetching good results in developing participatory field channel and other canal structures design. The representatives who were initially discussing only on physical works started exploring alternatives for efficient water management. Establishment of dummy/informal project level committees is yet another technique adopted in PTP.

1- Mr. R. Doraiswamy is working as water resource specialist is with JalaSpandana – South India Farmers Organisation for Water Management, Bangalore, India. JalaSpandana is a non-governmental organisation formed by the representatives of water users associations in South India. Contact: doraiswamyr@vsnl.net, doraiswamyr@rediffmail.com, www.jalaspandana.org, Phone: 91-80-22286161, 09448268401, Address: 72, 7th Cross, Chikkathayappa Street, Vasanthnagar, Bangalore 560052, India.
Mr. R. Doraiswamy is thankful to I & CAD, GOAP and to Mr. S.P. Tucker, Principal Secretary, I & CAD, GOAP.

1. INTRODUCTION

Worldwide the need for farmers to participate in the management and distribution of water for irrigation purposes is recognised. As the water for irrigation purposes is getting scarcer with the passage of time and increase in population the need for optimal utilisation of the resources is felt throughout the world. One of the methods identified is to make the irrigator responsible for his act through an institutional structure in which farmers participate in governance, management and finance of irrigation. Andhra Pradesh is one of the pioneer to adopt PIM in India (Peter 2001).

The experiences in investment in irrigation infrastructure in India, including Andhra Pradesh reveals that enormous amount is spent on Hardware component of Irrigation system like construction of dams, canal network, command area development including land leveling and crop loans. The software component of Irrigation system like capacity building exercise, which is essential for the utilization of hardware component of irrigation systems have not been given adequate attention. Thus leading to under utilization of water compared to desired results as envisaged in the design characteristics of the irrigation system (Wade 1982).

The Capacity building exercise and strengthening of farmers' involvement in water management in irrigation system is necessary to increase the momentum of water sector reform. Farmers are generally excluded from the process of preparing training contents, and are mainly conceived as passive listeners or receivers only and implementers of skills and expertise imparted during the training programmes designed by others. It is posited that an explicitly multi-stakeholder training programme process and balanced representation of the different interest groups in that, including farmers, will enhance the quality, acceptability and pace of irrigation system improvement (Narwani 2005).

The first section of the paper deals with the Introduction and area profile, section 2 deals with Participatory Training Programme concept including Micro Plan Preparation, Participatory Modernisation Programme and Water Users Research Facility. The third section deals with the Methodology of PTP in which Training Need Assessment, Training Modules and Impact Assessment is discussed. Fourth section deals with Lessons learnt, followed by fifth section which lists References[1].

Irrigation and CAD, GOAP supported JalaSpandana to carry out capacity building exercise in three major irrigation projects namely Rajolibanda Diversion Scheme (RDS), Priyadharshini Jurala Project (PJP) and Kurnool Cuddapah Canal (KCC)[2] in Krishna Basin in Andhra Pradesh[3]. The PTP was carried out from January 2005 to mid 2006.

1- The detailed report of PTP in RDS, PJP and KCC can be obtained from writing to jalaspandana@yahoo.co. in or visit www.jalaspandana.org.

2- Rajolibanda Diversion Scheme is fifty year old project, PJP is new project in which the notification and area delineation is yet to be taken up across the command area and KCC is about 130 year old project, which is undergoing modernisation programme with the financial loan from Japanese Bank of International Cooperation (JBIC).

3- Irrigation and CAD, GOAP empanelled NGOs and assigned the task of carrying out PTP in other irrigation projects in Andhra Pradesh (I&CAD forth coming publication on Sustainable Water Resource Development in AP).

1.1. AREA PROFILE OF THREE PROJECTS IN ANDHRA PRADESH

Table 1. shows JalaSpandana engagement in PTP in AP

Name of NGO	Irrigation Project	No. of WUA	No. of DCs	WUA area (ha)	Villages
JalaSpandana	Rajolibanda Diversion Scheme	34	6	35425.00	79
	Priyadharshini Jurala Project	5	-	4500.00 ha*	27
	Kurnool Cuddapah Canal**	86	14	1,60,000 ha	346

* In addition, PJP provides water for 12,145 ha to the RDS tail end command area.

** JalaSpandana with other two NGOs namely APARD and WCUSS carried out PTP in KCC.

2. CONCEPT PTP

The experiences during the field work in irrigation systems reveals that there are number of problems inbuilt in the training programmes imparted in the capital and district centers. These trainings have limited time bound programmes, which are never easy to encompass all the complexities of the irrigation system, which again can be registered by the participants in short duration. The need of the hour is to see the training programmes as continuous process of capacity building. Most irrigation systems have huge command area and to reach all these users needs a thorough investigation while preparing the training module.

It is not enough to merely create users institution to turn and take over the responsibility of water management in irrigation systems, which is complex and dynamic features in terms of social, economic, technical and political fronts. The participation of users in any institutional activities do not make any meaning if it confines to members turning out to vote during elections only (Inbanathan, Bhagyalakshmi and Doraiswamy 1997). The task of government and non-government agencies in capacity building exercise is ever increasing phenomenon particularly as we move towards building users institutions. Many times it is felt that the task of capacity building is over with the formation of users' institution at various levels, but the true fact is that the responsibility to increase the capacity among users' increases as we move forward. Thus we need to explore the viable institutional mechanism to install training centers in each of these projects on a permanent basis. The attempt will also focus on **'supply driven and self driven'** training module.

The concept Participatory Training Programme (PTP) is evolved to enrich farmers with all the management techniques by involving them in all aspects of the programme. The PTP gives opportunity for the users to understand the problems and its implications in the irrigation project and also enables them to realize the mistakes committed by some farmers. The PTP is more encouraging to clarify apprehensions on different practices and evolve strategies to manage the system efficiently. One of the major attention is to simplify the rules, regulations and other day to day business of WUAs, so that the farmers can manage it like any of their own business. The programme aims to develop number of farmers field school, which in turn carry out the training programme and reach many farmers in the region (Doraiswamy and Mollinga 2004). The perceptions of water users and experts on water policies, Irrigation Act, Rules and Regulations help modify and design comprehensive policy and move towards contractual agreement (Mollinga 2004).

This training programme undertakes a new type of activities in three parts in the process of developing effective training materials and organizing training programmes for dissemination for efficient water management in irrigation systems in Andhra Pradesh, South India, which has so far been characterized by government-initiated training programmes and managed by few professionals. The training the general advocacy of participatory approaches to its logical conclusion, by initiating multi-stake holders emphasising farmers' involvement in preparing and dissemination of the training module in order to increase and strengthen their role in water sector training programme formulation and implementation.

2.1. AIMS AND OBJECTIVES OF PTP

The aims and objectives of the training programme are to carry out training needs assessment in irrigation project area, develop participatory approach in training needs assessment, assess the capabilities of users in water management at various levels, carry out capacity building exercise, increase the productivity per unit of water, food and employment security, reduce brewing water tensions in the region, assess the feasibility of application of computers and simputers and explore the possibilities of viable and feasibility of sustainable training centers in project area

3. METHODOLOGY OF PTP

The training programme consists of three parts namely Training need assessment, Training and Impact assessment, which was carried out in participatory approach with participatory monitoring and evaluation mechanism, through involving different stake holders like farmers, department officials, elected representatives in the region at all levels, NGOs and other institutions.

STEP BY STEP APPROACH

PRE-TRAINING

1. Benchmarking of WUAs
2. Action research on micro and main system/project performance
3. Unstructured meetings with all WUAs at project level
4. Participatory identification and establishment of centre and sub centers for training
5. Social, Physical and Natural capital documentation
6. Involvement of officials of I & CAD and others right from the beginning

7. Formation of project level informal committees of WUAs
8. Participatory action plan
9. Entry point activity
10. Participatory identification and establishment of model distributary, farm and WUA
11. Participatory training module preparation in an integrated approach on IWRM
12. Preparation of concept note and subsequent action plan for various issues
13. Facilitating the preparation of video documentation on water issues

3.1. TRAINING NEEDS ASSESSMENT

The training need assessment, carried out in participatory action research approach adopting extensive and intensive facilitating and enabling conditions to elicit information required for the training module reveals ground realities and ways to overcome such predicaments (Naik et al 2002). The following are some of the findings that emerged during the training need assessment.

- Water users, department officials and other stake holders in the command area have great potential to make PIM success
- Extension services related to water conservation technology and agriculture is poor.
- Water and crop productivity is below the expected level, for instance, paddy average yield in the region is about 30 bags per acre, which could be increased up to 50 bags by adopting different technologies.
- Representatives of WUAs, and department officials do not have holistic picture of project performance since its inception till date.
- Modernisation programme lay emphasis on physical works.
- WUAs are not involved in modernisation programme, as a result tampering of structures of canal system continues.
- WUAs not keen on water tax collection due to mechanism deficiency, Revenue Department is not apportioning the water tax to WUAs. As a result, WUAs are not getting their due share of money to carry out operation and maintenance of canal system.
- Sharing of data on the water tax collection by Revenue Department to Irrigation Department and WUAs is missing and cumbersome process.
- Wide gap in potential created and utilized in RDS project - Tailenders deprivation
- Lack of knowledge on the rules and regulations of APFMIS Act.
- Informal arrangements like community *lashkars* (water man), patrolling on the canal system towards managing scarcity.
- None of the WUAs had established WUA offices and only one WUA had records

pertaining to WUA.

- Informal project level WUAs committee formed under FNWSR supported by INPIM showed great potential to develop as pressure group and lobby for PIM (JalaSpandana 2004 & 2005).
- No financial support from Government to make WUAs sustainable.

3.2. TRAINING

In each of the irrigation command area, one main training centre and several regional centers depending on the size of the command area were established to suit the convenience of the farmers spread across the command area right from head reach to tail reach. The training components will focus on Social, Political/Institutional, Economic, Technical and Management issues related to irrigation and development. The trainings were given to farmers, representatives of WUAs, department officials and other stake holders.

As the capacity building is carried out in major irrigation projects with large number of WUAs spread across large canal network, the training programme was strategically designed in a participatory manner to reach all WUAs and farmers.

1. General training carried out to all WUAs and farmers in project area
2. Intensive training to establish fair representation of model WUAs
3. Too intensive training to establish model farm and farmers field school
4. Participatory approach to modernisation of irrigation project (blending social with technical)

TRAINING MODULES

MODULE – I (WUA ROLE, RESPONSIBILITIES AND FINANCIAL MANAGEMENT)

1. Know your project – SRSP project and its modernisation
2. Participatory Irrigation Management and its importance
3. Formation of WUAs and its objectives
4. Andhra Pradesh Farmers Management of Irrigation Systems 1997 Act (APFMIS)
5. Role of Irrigation, Agriculture and Revenue Departments in PIM
6. Functions of Presidents, TC members, sub committees and general body
7. Maintenance of accounts and book keeping
8. Gender issues
9. Sustainability of WUAs

MODULE – II (IRRIGATION MANAGEMENT + PROJECT VISIT)

10. *Warabandi* – Rotational Water Supply
11. Irrigation Projects – Water distribution system and maintenance of structures
12. Methods of Irrigation – Surface, Sprinkler and Drip Irrigation
13. Water logging – Salinity and drainage
14. Water balance and Conjunctive use of ground water

MODULE III (WATER MANAGEMENT IN DIFFERENT CROPPING SYSTEMS)

15. Systematic land development
16. Soil, water and plant relationship
17. Water Requirement for different crops and critical stages
18. On-farm water management
19. Water management in horticulture crops and fruit crops
20. Water management in ID crops

MODULE – IV (SRI PADDY, FARM MECHANIZATION AND FIELD VISIT)

21. SRI (Paddy) method of cultivation
22. Farm mechanization

MODULE – V (IMPROVED CROPPING SYSTEMS)

23. Soil testing and its importance
24. Fertilisers and Integrated Nutrients Management
25. Integrated Pest Management
26. Bio-pesticides and Bio-fertilisers
27. Organic farming

MODULE – VI DAYS (LIVELIHOODS MANAGEMENT UNDER WUA)

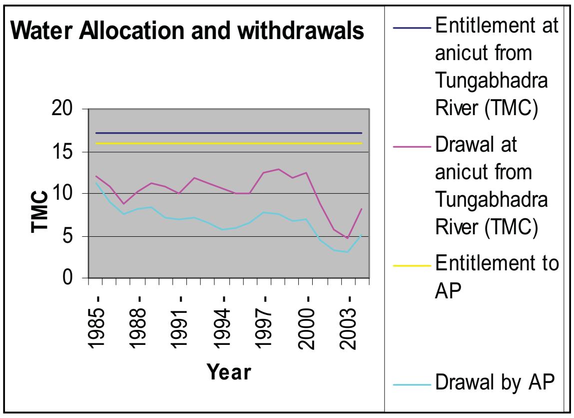
28. Impact of Irrigation Projects on Environment and Environment management plan
29. Livelihoods development – diversification of agriculture, animal husbandry, value addition services to the products, market linkages.
30. Community health and sanitation with reference to water sector

TRAINING OFFICIALS

The policies and programmes towards decentralization that calls for devolution has created a fear among the section of the stakeholders that they get displaced in the due course of accommodating participatory programme. On the day to day activities the existing staff of I&CAD can become more productive and play important role in improving water use efficiency, which is very essential during the take off stage of PIM (Diemer and Huibers 1996). Farmers participation in irrigation do not eliminate the role and responsibility of the Government organisations and agencies in irrigation. This perhaps may be true in the long run or calls for redefinition of roles and responsibilities of different stakeholders in the system. The Government staff can take over the role of mobilizing, organizing, training and provide technical support in design, operation and maintenance of the system through which there could be substantial contribution from their professional background.

WURF

One of the main draw back in the irrigation sector is the wide gap in the knowledge between the professionals and the users. Several research topics undertaken by various researchers from various professional institutes have not made sincere attempt in transforming the research finding to the users (Pastakia 2002). The findings of many research topics that concern farmers and system managers in their day to day business of irrigation management is not shared with the users from whom the primary and secondary data is collected. Of late, in addition to the existing pattern of research both academic and development, concept like Water Users Research Facility is being propagated. The main proponents of this concept are Dr. Peter Mollinga[1] and Mr. R. Doraiswamy[2]. Attempts are being made to facilitate farmers to identify the problem areas that needs to be researched upon for better understanding and initiate actions accordingly. The **graph** was prepared and showed to stakeholders to understand how the RDS project is functioning over the years.



MICRO-PLAN

PTP helps preparation of micro-plan, which constitute detailing of the activities that is intended to be taken up during the pre crop season and crop season period at the level of WUAs. In the past, the micro-plan include budget estimates for the activities like physical works i.e. the repair of the canal networks and other irrigation structures. These estimates were prepared exclusively by the staff of irrigation department, which was not conducive for promoting participatory irrigation management. The threat in the conventional method is that the water users i.e. farmers would take back seat and depend on the staff of irrigation department to identify works and even to obtain the

1- Dr. Peter P. Mollinga, Senior Researcher 'Natural Resources and Social Dynamics' ZEF (Centre for Development Research), Department of Political and Cultural Change, Walter Flex Str. 3, 53113 Bonn

2- Mr. R. Doraiswamy, Water Resource Specialist, JalaSpandana – South India Farmers Organisation for Water Management, Bangalore - India basic information about the water tax pricing, demand and collection (Dinar and Subramanian 1997).

MODERNISATION

PTP enables conceptualize canal modernisation programme that blend socio-economic and political factors with technical factors of irrigation system will be the central focus within the overall agenda. On the socio-economic and political front, we emphasise on the process of design and implementation through participatory and collective decision making approach. The social engineering, which was one of the missing link is roped in the process of irrigation development, that includes establishment of new infrastructure and modernisation of existing infrastructure.

Some of the advantages of this exercise is to improve water delivery service to farm, improve water use efficiency and irrigation project efficiency, create we feeling among the users, prevent tampering of canal structures, increased yield, ability to shift to new crops and methods like System of Rice Intensification (SRI), empower farmers to raise resources including water tax/charges/rates for the regular operation and maintenance, improved quality and quantity of work, etc (FAO 2003). In addition, issues like water conflict between farmers and system managers and among farmers is intended to reduce.

WUAS AS FARMERS FIELD SCHOOL (FFS)

The trainers of JalaSpandana develop WUA as Farmers Field School also to further up the training programme in its jurisdiction. This approach enables us to reach all farmers in the spread out command area. The WUAs as FFS in this approach is felt essential to make considerable impact on the command area. In other words, the linkages among the trainers, FFS and general farmers is strengthened to make large scale irrigation system function effectively. The FFS shall focus on water management, water distribution, SRI paddy cultivation method, organic manure, vermiculture, less cost/no cost inputs like panchakavya, herbal decoction, etc. The trainers or extension service people of JalaSpandana played facilitators role in promoting FFS.

LEAD NGO

The involvement of NGOs in canal irrigation projects for capacity building is negligible when compared with tanks and watershed programme, especially projects supported by World Bank. JalaSpandana played a role of lead NGO in K.C.C to promote NGOs participation in major and medium irrigation projects. In KCC two NGOs namely APARD and WCUSS were given training on irrigation management in large irrigation projects and encouraged to carry out PTP.

STUDY TOUR

JalaSpandana organised study tour to representatives of WUAs, department officials and other stake holders to personally visit their dam site and canal structure to know their project.

FARMER TO FARMER TECHNOLOGY TRANSFER

JalaSpandana has promoted farmers as trainers and deployed experience farmers in SRI paddy cultivation and organic farming to train the farmers in command area. This method of 'Farmer to Farmer Technology Transfer' has been strength of winning the hearts of the farmers of command area to adapt changes in the existing practices of water distribution and crop management. The mass communication like village drum beats, cable connections, wall paintings, posters, etc will be extensively used in the programme. JalaSpandana has employed representatives of successful WUAs to train the representatives of WUAs.

MODEL FARMS

JalaSpandana is engaged in developing Model farms in K.C. Canal in different locations of the command area. This model farm shall be self illustrative in terms of water and crop management with special emphasis on livelihoods. The action plan to develop model farms covers field oriented training programmes with package of practices on using advanced technologies, free cost and low cost technologies, automated water regulation and distribution, IPM, Organic farming, etc.

EXIT STRATEGY

JalaSpandana designed PTP with the involvement of officials, farmers and representatives of WUAs with the objective that at the earliest, the PTP become the responsibility of the representatives of WUAs and Department officials. The realization that PTP is the integral part of irrigation management both by department officials and WUAs is crucial for the sustainable PIM. The study tour organised in these projects were designed collectively and the responsibility was taken up by Irrigation Department. The presentation of the progress of PTP carried out by JalaSpandana, after some training was taken over by Irrigation Department officials, this shows the involvement of officials in PTP.

3.3. TRAINING IMPACT ASSESSMENT[1]

The basic objective of the training programme is to produce good output at the end of the training programme both in terms of quantitative and qualitative. Although, targets were set to undertake the training programme like the number of trainings to be imparted to different stake holders, the experience in the field shows that some of the trainings were required to be conducted more than the days stipulated in the six training modules prepared and circulated by I&CAD and WALAMTARI. We will discuss these issues in detail as we take up topic by topic.

- Parameters derived based on bench marking (PIM logistics, tail end deprivation, water use efficiency, office establishment and record maintenance, democratic functioning of WUAs, water scheduling and conflict resolution) and inputs provided in relation to issues identified.
- Participatory situational analysis

1- Please note that this is not an exhaustive list.

The **establishment of training centers and sub centers** in command area draw good response from various stakeholders in the irrigation projects. It was relatively easy to organise meetings as JalaSpandana was based in the command area and was accessible to farmers 24/7. WUAs who were only complaining against department for not delivering water in time, after PTP realize their roles and responsibilities and became pro active to address water issues.

One of the major achievement in PIM domain was the we feeling and **sharing of PTP** responsibility by representatives of WUAs and department officials in organizing trainings, study tours, data sharing, etc. In RDS project 30 out of 34 WUAs **established offices** and relevant records including gauge records and water tax. The remaining 4 are in extreme tail end are in the process of establishing offices. In PJP, all the 5 WUAs established offices and other details as mentioned above and in KCC, 78 out of 86 WUAs formed offices and other records. In these projects **28 model WUAs** were formed under PTP, which also function as users school. Some of these WUAs are supported with farm equipments to demonstrate income generating activities for the WUAs and **enhance livelihoods**. These WUAs are making good progress in development of WUAs, participation in water management, water tax collection, etc. **Tampering** of canal structures have been reduced to large extent.

Informal project level committee were formed in PJP and KCC and the existing informal project committee in RDS project formed under FNWSR supported by INPIM was further strengthened. WUAs participate in the water management at primary and main system level. Informal practices like community water man are being scaled up to cover the whole system to ensure efficient use of water. The regular discussions regarding water management is taking place after PTP between department officials and WUAs at various level.

The **water use efficiency** is increasing from 5 acres per MCFT of water to 7 acres per MCFT of water. PTP established 436 FFS covering an area of 1058 ha on SRI paddy method, ID crops and organic farming. Paddy **yield increased** 10 bags in areas where farmers field schools were established, particularly SRI. In selected distributaries, in these projects **volumetric supply** is introduced on pilot basis. In some WUAs, like for instance, Wadepally mandal in RDS project has made 100 per cent water tax collection, which is possible only due to WUAs participation.

The representatives of WUAs participate in **policy recommendation** to the government. WUAs are demanding government to hand over the water tax **collection responsibility**. It is worth mentioning here that prior to PTP, WUAs were not willing to take over the responsibility of water tax collection due to fear. I & CAD is considering transferring water tax collection responsibility to WUAs. All the WUAs in RDS, PJP and KCC prepared **micro plan** for their WUAs for the year 2005-06 and submitted to the Irrigation and CAD.

Irrigation and CAD and JalaSpandana prepared draft version of **Memorandum of Understanding to transfer water tax collection** to WUAs, which will be signed by the President of WUAs and Executive Engineer or equivalent representing irrigation department. The MOU speaks of the water tax rate and incentives and disincentives in timely collection. This is also translated into Telugu and the same was discussed before representatives of WUAs.

During PTP, the livelihoods of **the tail end farmers** were shown and explained to the farmers in the head reach and the effects on soil that would occur due to excess irrigation in the long run. At present the head reach farmers in head reach distributaries of RDS are not facing shortage of water. The issue before the WUAs and Irrigation Department is to undertake operating of sluices and gates. In RDS, which was facing severe tail end problem, is being coordinated with informal project level committee and enforcing rotation system of water distribution called as *Warabandhi*.

The first **computerization of WUA administration** perhaps in India was attempted in RDS by JalaSpandana and succeeded with the cooperation of WUA representatives. The WUA No. 7, Mandodi of RDS project was selected to experiment computerization of records pertaining to WUA functioning, list of TC members, voters list, project information, etc is installed and being successfully. The recent visit by APERP delegates also took note of this computerized WUA. The computer is being operated in English and Telugu and the necessary training required to operate the computer is being provided to the representatives of WUA by the JalaSpandana.

4. LESSON LEARNT

PTP is being carried out for the first time in Andhra Pradesh with commitment by the officers of I&CAD at all levels and WALAMTARI through NGOs in large canal irrigation system. PTP is the right way of training programme as different stake holders realize their roles and responsibilities and in three years period, the project committee of WUAs or Department officials show the sign of taking over the training as part of water management. The department officials and WUAs prove great potential to resolve majority of the issues including tail enders and operation and maintenance issue.

The **time** frame for PTP in these large irrigation projects given the magnanimity of the issues and work in large irrigation project **is inadequate**, the field experience shows that at least three years is necessary for NGOs to prepare the ground fully and **exit**. There are issues at policy, project and micro level that need constant support from external agencies like NGOs. Thus arise need to institutionalize PTP for minimum of three years through NGOs and later built into irrigation management by PCs or I&CAD. The modernisation programme right from the beginning needs to incorporate PTP. As the distributary committees are formed in the month of December 2006, the training at mezo level system maintenance should be carried out to the newly elected representatives of DCs. The intensified PTP in large irrigation projects compounded with policy reforms certainly make PIM success in AP, particularly in the wake of policy making WUAs continuous body with every two years election to one third of TC members.

The visits made by the higher officers of I&CAD, professionals from FAO, JBIC, INPIM (Hatsuya Azumi), Australian experts, and other field tours boost the morale of the PTP.

INPIM may commission study on PIM in Andhra Pradesh both from policy perspective and field situations for the benefit of larger interest of PIM. Further, it would be appropriate for INPIM to support activities like Farmers Network for Water Sector Reforms and Develop PTP.

5. REFERENCES

1. Diemer G and Huibers PF 1996. Crops, People and Irrigation – Water allocation practices of farmers and engineers, Intermediate Technology Publications, UK.
2. Doraiswamy R and Mollinga P 2004. "Tailenders and other deprived in Karnataka". In Rajagopal A, Doraiswamy R, Mollinga P Peter, Joy KJ and Suhas Paranjape (eds) *Tailenders and other deprived in irrigation in India: Tamil Nadu, Karnataka and Maharashtra,* CWP Research Series No. 14. Irrigation and Water Engineering, Wageningen University, The Netherlands.
3. Dinar Ariel and Subramanian Ashok (etal) 1997, Water Pricing Experiences, An International Perspective, World Bank Technical Paper No. 386, The World Bank, Washington DC.
4. FAO - 2003, Unlocking the potential of agriculture, www.fao.org.
5. Inbanathan A, Bhagyalakshmi TA and Doraiswamy R, 1997. Democratic Local Governance: The Case of Panchayat Raj in Karnataka (A State in South India), paper presented to the USAID.
6. JalaSpandana 2004 & 2005, Farmers Network for Water Sector Reforms in South India, Unpublished project report, JalaSpandana, Bangalore.
7. JalaSpandana 2006, Participatory Training Programme in Rajolibanda Diversion Scheme, Priyadharshini Jurala Project and Kurnool Cuddapah Canal in Andhra Pradesh, Unpublished reports, separately for each projects.
8. Jalavani 2005, WUAs as Users School, Jalavani- Farmers Newsletter, AP JalaSpandana, Hyderabad.
9. Mollinga P, Doraiswamy R and Kim Engbersen 2004. Capture and Transformation: Participatory Irrigation Management in Andhra Pradesh, India. In Mollinga P and Bolding A (eds) *The Politics of Irrigation Reform - Contested Policy Formulation and Implementation in Asia, Africa and Latin America,* Ashgate Publishers, England
10. Naik G, Kalro H A, Brewer D J, Samad M and Sakthivadivel R, 2002 Assessing the Impact of Irrigation Management Transfer – Case studies from Maharashtra, Oxford & IBH Publishing Co. Pvt Ltd, New Delhi and Kolkatta.
11. Narwani G.S. 2005, Community Water Management, Rawat Publications, Jaipur and New Delhi.
12. Pastakia Astad, Kothari Brij and Chand V Sherry 2002, Farmer-led Participatory Research, Cases from Western India, Books for Change, Bangalore.
13. Peter, J Raymond (2001) Irrigation Reforms in Andhra Pradesh, India, paper presented at International Email Conference on Irrigation Management Transfer, June –October 2001, FAO and INPIM.
14. Wade Robert 1982, The System of Administrative and Political Corruption: Canal Irrigation in South India, The Journal of Development Studies, Vol. 18, No 3, April 1982,pp.287-328.

IMPACTS OF FARMERS' NGOs ON SOCIO-ECONOMIC DEVELOPMENT OF QAZVIN AREA

Ali Ghasemi [1]

ABSTRACT

Connoisseurs believe that inefficient management in operation and maintenance of irrigation system is assumed as a key element in weakening irrigation performance. Based on experiences, removal of existing inconsistencies and challenges will not realize without people's participation. Building capacity for enhancing participation and involving both practitioners and users in water management and in saving of resources and costs, would greatly help settle the bottlenecks. Along this path, developing local mechanism and managerial set-up, shall either pave the way for broader saving of water and optimizing the demands, and/or form the main factor in elimination of local or even international conflictions.

The author had the chance, to formulate and implement a strategic plan for establishment and operation of NGOs (Non-Governmental Organizations) in Qazvin plain mobilized by face to face communication towards further involvement of his staff (Qazvin Irrigation Management, QIM) and target farmers in the process. Later, based on a timing schedule, an action plan became operational to gradually shift exploitation and maintenance of existing irrigation-drainage network to the local community. To this end, various commitments e.g., selling, inspection, registration, distribution and delivering water quotas are to be implemented by corporate Water Users Associations. They are also obligated for maintenance, dredging, and fixing hydro-mechanical segments (Amil) and turn-out structures. The local leaders, apart from foregoing services and continued inspection of structures and operational processes, are responsible for fulfilling the demands, settling the problems on the spot[2] and preparing daily reports on possible offending in the network. Implementing IMT (Irrigation Management transfer) initiative in Qazvin, has resulted in numerous cultural, social and economic impacts especially in the area of improvement of irrigation management and has created structural changes towards the great objective i.e. "Equitable distribution of water" in the network. In view to dimensions of the transferred liabilities to local pioneers in Qazvin, and in order to attract supports from national and international

1- M.Sc. in Irrigation Structures, and Managing Director of Qazvin Irrigation Management Co. (QIM), & Initiator and Executive of Qazvin Participatory Irrigation Management Project. Address: Shahid Bahonar Bulvd., Qazvin, Iran. Tel: +98281-2233-187, Email: ghasemi_ali2@yahoo.com

2-The existing WUAs consist of 7 sub- offices scattered over the main villages along the subsidiary channels.

institutions for development of participatory Irrigation Management (PIM) in Iran, the existing irrigation system was adopted as a national pilot in Qazvin.

Key words: Water Users' Associations (WUAs), Irrigation Management Transfer (IMT), Qazvin, Local Irrigation Management (LIM), National Pilot.

1. FOREWORD

IMT initiative in different countries has led to remarkable achievements including**:**

- Improved economic status and higher income for farmers;
- Enhanced maintenance system;
- Greater irrigation efficacy;
- Lower public staff ;
- Upgraded management system;
- Increased water charge (rate);
- Decreased political elections for managers**;** and
- Lower farmers' conflictions on water quota.

The initial stage in IMT promotion consists of capacity building and institutionalizing for upholding new commitments. There are varying processes and efforts required for empowerment of the target beneficiaries in different cultures and societies. Executive bodies, if abide themselves with following three issues, will succeed in their operation:

A. Giving signals: Reaction and affection received by socio-economic messages;
B. Balance of interests: Provision of general facilities in favor of beneficiaries' interests and their promotion; and
C. Fulfillment of commitments: Due liability and accountability against the decisions taken.

Initially, in 2004, an integrated plan for re–organization and transferring the incumbencies was proposed together with identification and screening of effective details and perspectives in participatory development of irrigation management. Further, the author tried to act as an impetus to mobilize and launch the IMT initiative in Qazvin and then across the country. The work plan became operational in line with human resource development, encompassing QIM staff and its counterpart beneficiaries in Qazvin plain. The first step of the work was documentation of executive methods and regulations, studying and registration of official hierarchy of governmental structures and the rate of their effectiveness in irrigation management. Meanwhile, the needed set-ups for covering the farming groups in lateral channels IV (10 farmers), common–wealth farmers association in a farming block (200 farmers), local management entity (union) covering the associations (158 associations), and eventually, their provincial irrigation Federation with 30,000 farmers were also taken into account. This task has resulted in incredible gains in the process of management transfer and bureaucratic reduction at provincial level. Outstanding reduction of operation and maintenance cost, as well as saving time in both public and community side, shall also be regarded as the new IMT achievements.

Many experts and clients recognize that the initiative, in particular, when concerns to improvement of agri–water distribution and promotion of monitoring roles played by local users, is well-designed with dynamic performance. They mainly praise innovation of farming–corporative arrangements, institutionalization in local management of Qazvin water, and its possible impacts on prompt irrigation management at national scale.

2. INSTITUTIONALIZATION FOR MANAGEMENT TRANSFER

2.1. GENERAL DETAILS OF QAZVIN DEVELOPMENT PROJECT (QDP)

The "Qazvin Development Project-QDP"[1] was approved in 1967 and its first phase composed of deviation checks, main and lateral canals constructed by 1976. The second phase also covered the remaining channels and structures in 1991 followed by the third phase which created the Taleghan Dam and its reservoir in 2001. The project now consists of the dam, reservoir, and deviation dams (Sangban and Ziaran) conveying tunnel and the extensive irrigation system of Qazvin plain.

The dam receives the Taleghan River (a sub–branch of Sefidrud) to shift it to the northern margins of farmlands in the plain, as well as supplying partial drinking water for Tehran . The network comprises of 94 km. main canal, 220 km. canals II (12 branches), 33 km. lateral channels III (158 branches), and 550 km. subsidiary channels IV, with 30,000 branches and related outlets.

The operational area covers 80,000 ha. with net 60,000 ha. farm-lands in which, specific farming patterns and water needs are formulated upon climatic particularities. For instance, the approved ongoing pattern spells out for fall crops and cereals in 50% of the total lands, with summer crops allotted in 25% and the rest for fallow and other frequencies as required.

The operation focuses on mixed exploitation of surface (Taleghan reservoir) and sub-surface resources (water wells). Following, shows the annual water allocation of 460 mm3 for the network operation.

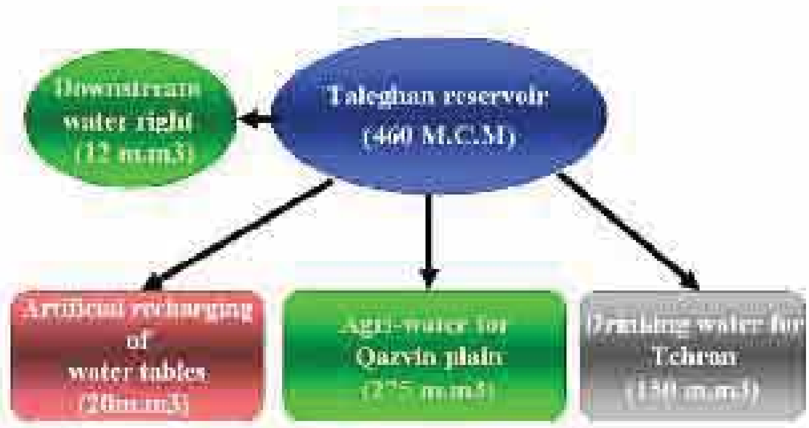


Diagram1. Macro–allocations of water from Taleghan basin

1- Formerly registered as "Ghazvin Development Project - GDP" by The World Bank

2.2. PLANNING AND TRAINING

A holistic scheme is the ultimate option in preparing an enabling condition for due thinking, identifying and processing of conceptions and wise application of information and tools under an overall synergy towards anticipated progression. No doubt, training conceptions supported by motivation and interaction would also help empower and involve the public staff and communal clients in constructive handling the new obligations.

Training and implementing programs have to follow a well-coordinated and group–oriented context with maximum adaptation to the operational procedures of every initiative. Forecasting and identifying the possible challenges of the new working atmosphere and liabilities' nature have to be well-addressed in advance. Rapid change and replacement of traditional managements or positions in public or community paces seem not practical easily, whereby only the management of change deserves the liability to take action in this regard. Water management strictly stresses on in-dept analysis and communication in the fields of psychology and sociology to pave the way for training and up-scaling the mind- sets towards formation of CBOs(Community-Based Organizations) in agriculture sector.

During IMT process, various training sessions were conducted on how to apply and exchange technical information, and on finding the way for maintaining the hydraulic structures. Moreover, it is believed that due capacities were also built to enable people's involvement into the project. Several meetings launched for briefing the experts, staff and farmers' representatives via brain-storming method, in which, creativity posed a high degree of importance. Community–based participatory management incorporates all stakeholders including the QIM staff, farmers' community, representatives of agricultural bodies and water authorities into all stages of designing, planning and operation with highest viability and feeling towards multilateral collaboration. In the "IMT" project, there seem remarkable indicators in awareness building with a tangible manifestation in the areas of knowledge and action, mainly owing to sense of ownership generated under an overall peer attachment.

2.3. SEARCHING FOR SUSTAINABLE LEGAL SETTING

Calling people's participation stands for retaining and operating the network under the IMT initiative. Normally, observing principles and concerns of the clientele and their social interests and tools, is greatly important in the process of public institutionalization. To this end, neither socio–geographical divisions, nor the scale of hydraulic structures, communication routs, residential areas, ethnic diversification and population are, in any way, accounted individually for strategy determination. In Qazvin project, it is learnt that the best approach shall focus on the canal divisions as the "joint pivot "for setting up the local management order. This approach recognizes agricultural groups and associations on the basis of farming- blocks' borders (as in case of the farm–plots adjacent to inlets linked to chancels III). Similarly, a confidential socio-economic support would strengthen and sustain the CBOs' milestone. The next business goes to consolidation of the water users' associations (WUAs) shaped around the secondary canals and assuming them under unions and ultimately the Federation of water users' associations.

Based on by-laws, executive management position and operation completely differ, so that, Federation managing board is assigned by general assembly followed by picking up the unions managers and experts, associations' water distributors (in farming blocks), and the heads of farmers' groups. Besides, all operational affairs in exploitation and maintenance of the network system are supervised and led by the existing hierarchy. TOR (Turns Of References) for every layer is also subject to general assembly's confirmation. In Qazvin, almost all legal and conventional capacities were experienced for registration and operation of agricultural CBOs. In reality, varying regulations are in action for operation of special or limited corporate enterprises, agricultural share-holdings, rural cooperation, water users associations or else under NGOs' context, but yet no such entities demonstrated an authentic output in irrigation service management. Moreover, due to lack of viable sample in Iran, several attempts made to find a "reliable legal system" though try and error method. It is strictly obvious that despite the failure of existing organizations, creation of Corporate Associations and their Apex Federation using the ongoing Labor Law of the Islamic Republic of Iran deserves an efficient structure in water exploitation management of Iran.

2.4. SEARCHING FOR EFFICIENT OPERATIONAL MANAGEMENT

Soon after legal structuring and institutionalization (bottom-up), an operational management (top-bottom) was inserted into the agenda with a well–defined and comprehensive flow-chart. This task, unlike the public structure, denies any idle or parallel designation and just recommends operational and administrative posts for the Federation as well as its affiliated unions via carrying out frequent need–assessments. Along this path, other measures were also taken as follows:

- Formulation of legal operation,
- Creation of maintenance and finance divisions in the executive management of Federation,
- Forecasting sale officers and water distributors in secondary canals; and
- Assigning focal persons in the water users' associations of lateral channels III.

Consequently, following diagram shows the 5-year records in Qazvin project under two distinct courses:

A. Planning, designing and implementing the NGOs development

Generation and development of NGOs' activities under the context of Corporate Association

B. Designing institutional set-up for participatory irrigation management(PIM)

Executive management in operation and maintenance of the network system under non- government management style

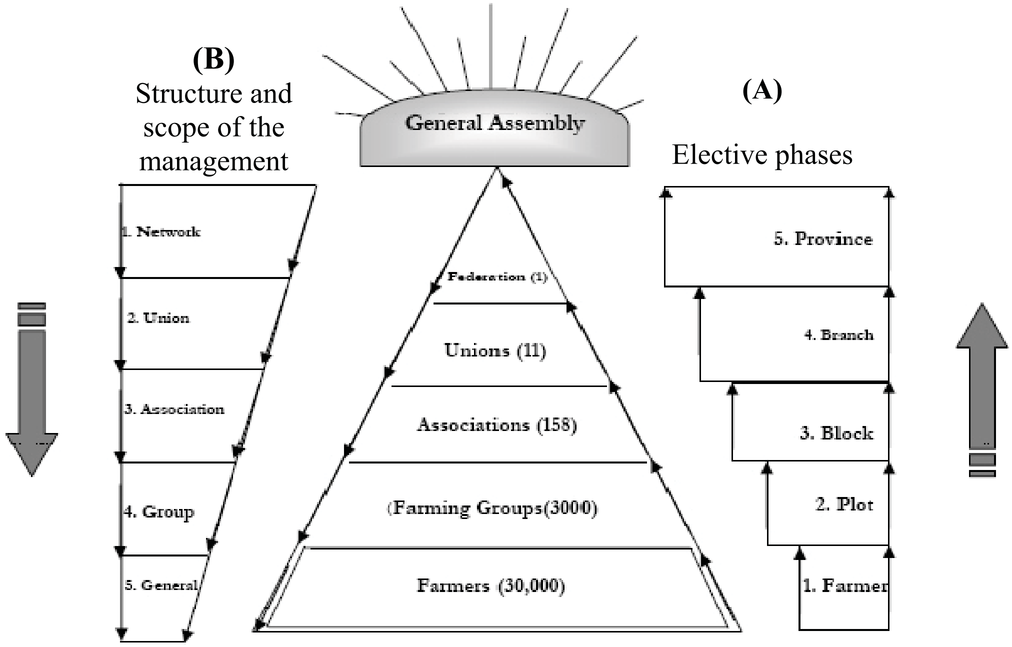


Diagram2. A) Institutionalization & structural setting B) Organization of executive management for WUAs in Qazvin

3. ECONOMIC IMPACT OF IMT ON THE PROJECT

More than 35 million USD[1] was invested for designing and structuring the irrigation system in Qazvin up to 1978. However, the latest economic reassessment (2006) came up with 475 million USD[2] as total project value excluding land–possession and designing charges. Presently, the network withstands excessive depreciation and failures owing to its over-dated segments and requires 15,000 USD for basic renovation and revival of canals, service roads, hydro-mechanical gates which control water surface(Amil), CHO and turn-out structures.

3.1. SAVING IN PUBLIC SECTOR

Pertaining to delay in construction of Taleghan Dam, water supply and its conveyance to Qazvin network had to follow the upstream river regime and has consequently decreased to 160 mm3 per year. The foregoing constraints together will other uncertainties, which mainly rose due to centralized and traditional public management, have led to serious challenges in operation and maintenance of the network system. High current and personnel costs, in line with inappropriate maintenance procedures, were the key constraints before the project operation. Comparing the latest performances realized by 5 Provincial Irrigation Companies, QIM depicts rather impressive output in squeezing the current operating overburden on government. As

1- Based on the then operation and construction prices (1$=70 Rls. in 1978)
2- Based on current costs (1$= 9200 Rls.)

seen in Diagram 2, in absence of PIM initiative, total running cost for QIM operation could have increased to almost 500,000 USD, whereas, it has noticeably reduced to 250,000 USD which means 50% saving in the same year's expenditures (2005), just because of performing successful PIM in Qazvin.

3.2. SAVING IN PRIVATE SECTOR

Attracting consumers' attention for every development intervention normally accompanies financial incentives, and to this end, the IMT initiative in Qazvin, parallel to expansion of human communications and saving cost and time, has also adopted certain economic motivation to mobilize participatory management pace.

In Qazvin, 30,000 farmers enjoy an average land ownership of say, 2 ha while there are 12 large agri-industrial holdings jointly using the irrigation network. Government has operated the network for 30 years and guided all administrative affairs through the provincial company (QIM) based in Qazvin.

Prior to the project implementation, farmers were widely suffering of time and cost imposition in referring their frequent requests to the Company .They used to travel long distances (average 60 km) to capital city bearing overburden for doing their water purchase or other affiliated businesses. Soon, these affairs were handed over to 3000 informal agents representing 30,000 farmers, some of them (almost 108,000 p/year), had to refer for transacting daily requirements.

Agricultural status of Qazvin plain reflects an extensively residential dispersion pattern encompassing various segments of the network. Therefore, assuming an average 60 km. as round-trip for every agent, they totally have to bear 6.5 million kilometer per year:

Number of referrals (trip):

400(average, farmer)*30(day)* 9(month) = 108,000

Total distance each year:

60(Km. each round-trip)*108,000(number of referrals) = 6,480,000 km

Total charge for agents' travel:

108,000 *12.45(USD-minimum salary each day) = 1,344,600 USD

The above overburden is almost equal to 130% of the total water rate which used to be unnecessarily imposed on rural households' livelihoods. IMT initiative in Qazvin has come up with remarkable reduction in referral distances (max. 5km.) and times (average 1 hour) for users' in settling their businesses with the local associations.

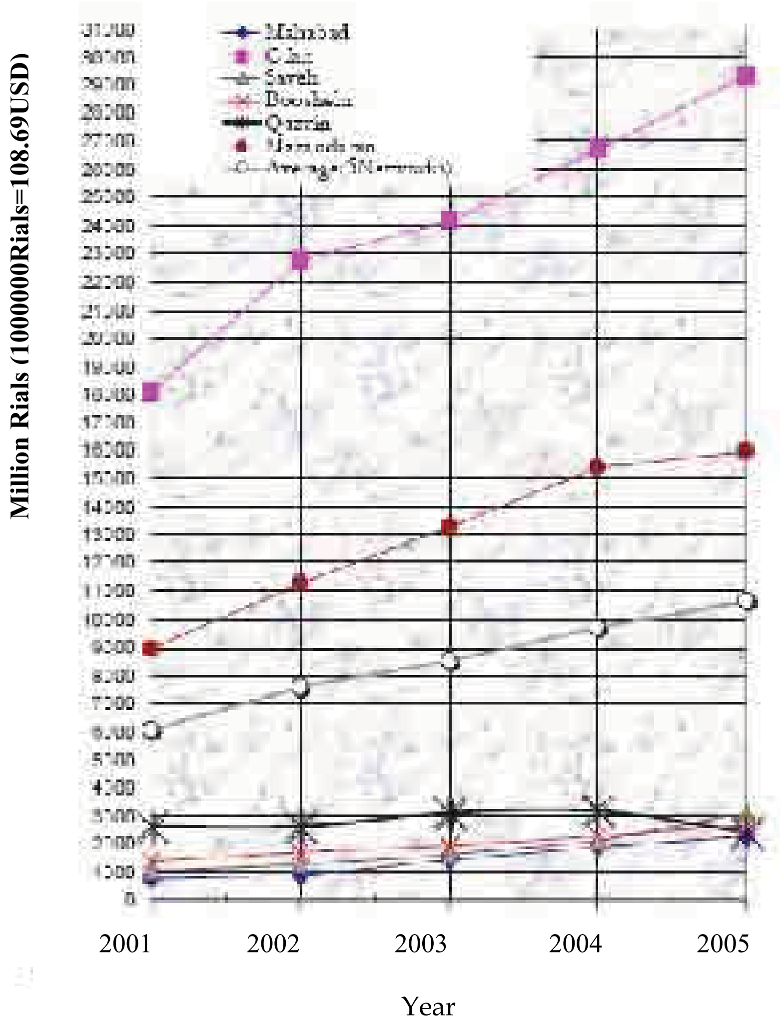


Diagram3. Comparison of current and personnel costs transacted by 6 main irrigation – drainage companies

3.3. DEVOLUTION OF HYDRAULIC STRUCTURES

One of ongoing discussions on IMT initiative links to the network ownership. Certain countries like Turkey, has successfully experienced the process of networks devolution to the organized associations mainly due to some crisis in operational management. This process, however, was assisted by different universities and the World Bank for smoother implementation.

In Iran and upon the National Law for Equitable Water Distribution (ratified in 1982), the Ministry of Energy was responsible for land acquisition, construction and operation of canals I & II, and the Ministry of Jihad-e-Agriculture committed in lateral channels III & IV. However, the Ministry of Energy undertook overall commitments after a Bill approved last year by the Cabinet.

Devolution process shall never rely on financial incentive alone, whereas it has to stress also on enhanced leadership and productivity. Leasing is also assumed for viable mechanism in shifting the network complex to local clients, and in particular, it seems much applicable in case of lateral channels II & IV.

Though, the idea would eliminate certain farmers' concerns, but in other spots as Tehran or Qazvin provinces, it may fail mainly for higher land price and possible institutional destruction of the networks segments to substitute them by other commercial holdings. Anyhow, the process, as realized in "Qazvin, Pilot" stands for a viable instance for wisely duplication elsewhere in irrigation schemes.

4. SOCIAL AND CULTURAL IMPACTS

Experts have identified the following inconsistencies as the key factors behind failure of irrigation management:

- Shortage of accessible water at delivery spots:
- Defects in metering devices:
- Poor financial facilities:
- Inefficient mechanism for exploitation and maintenance of the system
- Inequitable distribution of water;
- Misappropriation in agri–water charge; and
- Poor incentive for participation and saving in water issues.

In Qazvin, plus the aforementioned disparities, other issues as allocation of partial resource for drinking water purpose in Tehran and its political, population, and consumption burdens have crucial impacts on water management, too.

Therefore, it strictly entails appropriate interaction with key social, economic, cultural and political perspectives in the process of changing and reforming the operational set- up.

Regulating farmers' relationships and their operation areas with relevant managers in farming blocks' associations, as well as adaptation of TOR for water distributors in secondary canals with codes laid down by unions, and on top of all, prompt linkage with related public institutions, are all contained in the IMT process. Under this arrangement, the central Federation acts as a local – based parliament, in which, all representatives of secondary canals pose as managing board of the apex body. Due to some small scale unions and their vicinity, they may merge to shape rational sizes. At present, following irrigation service offices (unions) have been stationed over the network premises in Qazvin:

L1, L2, L3, L4-A, L5, L6, L7, M3, L8, and MW union which covers western area of the main canal inducing L9, L10, and L20 together with lateral channels.

Frequent inspection of the establishments, fulfilling the requests, settling disputes, and preparing daily reports on functions and possible interactions, lie within the unions' management. To this end, a training course titled "Social Prevention and Control Mechanisms" was held for WUAs in Qazvin. Various curricula including basic information on CBOs, general laws, direction to lawful actions, and the best ways for optimum exploitation of hydraulic structures, were adopted as training materials by qualified judges and also experts of Qazvin Irrigation Management Co.

4.1. ORGANIZATIONAL PARTICIPATION OF RURAL WOMEN

Paving the way for active participation of local users in water resource development schemes, logic disposal of sewage–water, and water use management, have so long been mainstreamed into the planning processes at global scales with merit cases in certain countries and mainly run via men involvement.

Since 1980, poor participation exposed by woman community in water planning and management trend, in line with negative consequences on service delivery and quality, been addressed by decision-makers. General up-scaling of women status and forecasting especial position for their role in socio–cultural perspectives are assumed as enabling mechanisms for water loss reduction and agricultural productivity promotion. Now, much emphasis is given to women's involvement into programming and implementing processes towards better operational management, and hence, constructive transfer of diverse network's functions.

Concerning the objective experiences gained in Qazvin project, women community had outstanding impacts on domestication of water industry as well as improvement of participatory management of irrigation system particularly for their appreciable discipline, interest in learning and proper interaction with clients. They greatly shared in successful commencement of the first IMT initiative conducted by QIM. Therefore, it seems much employment opportunities have to be provided for women fraction as to take advantage of potentially creative individuals but practically inactive forces of the society.

In line with expansion and progression of participatory irrigation management, reliable conditions shall also be generated for self-sustaining (Home Role) governance of the WUAs in Qazvin with following positive impacts:

- Reduction or elimination of unwanted bureaucratic cycles in decision-making process:
- Saving in farmers' time and cost;
- Decreasing current and general costs in network operating ;
- Lowering expenses for maintenance affairs throughout the irrigation system;
- Signifying local people's inspection towards equitable water distribution;
- Enhancing irrigation performance and farming productivity in Qazvin plain.

5. CONCLUSION AND RECOMMENDATIONS

Studies reveal that when CBOs are involved, even in semi-active situation, they would improve operation and maintenance of hydraulic structures. Farmers' participation and development of NGOs remark for pre- requisites in productivity assurance and enhancement. On the other hand, locally–adapted and genius methodologies underlie development process. Since there existed no local approach in QIM staff or community–oriented participatory research on irrigation system, the new PIM model in Qazvin concentrated the experts and researchers on a consensus in IMT methodology. Implementing structural reforms in operational system of Qazvin plain and substituting farmers' referrals by their Federation have resulted in numerous impacts with satisfactory reaction expressed by users.

Many experts and managers who visited the site, always praised the impressive impacts on comprehensive development trend, and hence, signified dissemination of dynamic management visions and mechanisms at national scale.

At present, viable interaction and coordination exist in all institutional segments and it is expected that upon supplementary measures including land consolidation, modern irrigation systems, and Remote Control and Management tools, the project can rise productivity indices or fulfill real and equitable water distribution and rapid information transmission.

Under such circumstances, local irrigation management in Qazvin has achieved maximum utility and capacity for its sustainability. PIM in Qazvin, as the first successful experience, deserves capability to create a viable ground for sustainable development in Qazvin and consequently across Iran. Following are certain recommendations in this regards:

5.1. EDUCATING THE QUALIFIED MANAGERS

Education process of qualified managers and transferring it from public sector to the society, incorporate participation of QIM staff and local clients within a transparent and accountable pace at various operational levels. Existing background on history of irrigation management and the followed methodologies indicate that problem settlement is not solely contingent upon physical issues, but rafter relies on various managerial elements. Hopefully, IMT initiative would encourage more accountability and productivity as well as rapid return of the costs.

5.2. GOVERNMENT SUPPORT

Rational, economic and sustainable use of water and soil resources deems impossible without willing for direct involvement of the end users and their direction towards a participatory management in water and agriculture sectors. In this area, any delay or change, undue interference or denial of responsibility, might collapse this national action and nullify the rights of soil and water resources and manpower. Therefore, stakeholders should emphasize on development of participation and underestimation of marginal issues.

Determination of "types, scales and duration of public support" in favor of agricultural NGOs, as well as extension of their independence and growth, calls for "structural reform in administration" (inaction of new regulations) to be addressed by key policy–makers in water sector. It is expected that upon legal, technical and financial supports followed by unanimity of the local and national bodies, due strategies will be developed for rational decision–making and action–planning. Moreover, concurrent to participation–oriented management, an integrated planning-bed is created to prepare public system and reorganize operational cycles.

A tangible public support, as specified by the 3rd National Development Plan (Article 107), is realized by partial refund of water charge to clients for financing general restoration and maintenance operations. This support would greatly meet the basic requirements foreseen in a holistic PIM system.

5.3. NATIONAL AND INTERNATIONAL PARTICIPATION

WUAs operational area and their TOR are well-determined, while facing certain shortcomings and defects, too. Indeed, setting close relationship and cooperation with national / international GOs and NGOs, shall mobilize the process. Global specialized agencies as ICDI, IWMI, INPIM and ILO can develop due partnership in monitoring and evaluation of PIM process as well as forwarding possible assistance to the project objectives.

Under a poly-dimensional consensus and synergy among all stakeholders concerned, the PIM approach may underpin the following priorities, inter alia:

- Implication of credit card system for remittance of water rate (charge): and
- Installation of 200 electronic metering devices at main spots.

6. REFERENCES

1. Archives, Provincial Office of Jihad –e-Agriculture.
2. Ghasemi, Ali (2003), New Discipline for QIM and the Status of WUAs. Proceedings of the 12th Conference of ICID, Tehran
3. Ghasemi, Ali. (2005). Tehran, Iran. Regional center on urban water management – Tehran. Workshop on Women's Participation in water Management, (proceedings)
4. Glasser,W . Reality Therapy: A New Approach to Psychiatry. New York: Harper and Row Publishers, 1965.
5. Habibi. Ali, Translation of "The World Development Report -2002", Institutionalizing for market. Axford university publication
6. Nouri Esfandiari, Anoush (2006), Women's institutional participation in water use management, publication of Tarrahan-e-Padideh, Tehran. Iran.
7. QIM Co. Qazvin
8. Researching Institute of Arvin Pajouh (2000), Exposure to participation system as the base for global and Islamic advanced management, publication of the Iranian Oil Ministry.
9. Sustainable Development in a Dynamic World: Transforming institutions, growth and quality of life, The World Bank, 2003
10. Tortajada, Cecila. (2003). Professional Women and Water Management, Case Study from Morocco, I WRA, Vol 28. No.4
11. Tousi, Mohammad Ali, (2000), "Participation- oriented Management" Publication of Industrial Management Organisation, Tehran, Iran.

RESEARCH PROJECT FOR IMPROVEMENT OF PARTICIPATORY IRRIGATION MANAGEMENT (THE TAFILALET AREA, SOUTH-EAST OF MOROCCO)

Mohamed Bousfoul and Mohammed Bourass[1]

SUMMARY

1- The research project for improvement of participatory irrigation management is a concrete follow-up of the Rural Development Project in the Tafilalet (PDRT). The Tafilalet is located South-east of Morocco, in the pre Saharan, south-of the Atlas mountains zone and extends over an acreage of 77 250 km^2, of which 60 000 ha are under irrigation. The region encompasses four major river watersheds: the Ziz, Ghéris, Guir and Maîder. It is divided into three major units: a mountainous slope on the southern piedmont of the calcareous eastern High Atlas in the north; an intermediate pre-Saharan region made up of highlands strewn with oases and a Saharan high plateaus region in the south .The area is renown for its natural constraints related to an arid climate and flood and desertification threats for the irrigation infrastructure impacting negatively on the productivity of the cropping systems in use. However, the area can take advantage of assets such as water resources development and irrigated crops.

2- During a mission carried out in the area by experts from the International Fund for Agricultural Development (IFAD), it was deemed necessary to undertake actions to upgrade users' capacities to deal with management of irrigation infrastructure. Based on the results of the mission, plans of the research project for the improvement of participatory irrigation management were developed and implemented. The project, financed through donations from IFAD ($US 490, 000), aims to set up prerequisites to make it possible for users to upgrade their intrinsic capacities through: (i) organizing themselves within Water Users Associations (WUAs) where water resources are available; and (ii) meeting operation and maintenance costs incurred by irrigation systems.

3- A pilot action plan has been implemented in two small-scale irrigation systems falling within the scope of action of the Tafilalet Rural Development Project (PDRT). The project has targeted two localities Jorf and Tinjdad where the problem of water scarcity is most acute. The plan is based on the following three basic

1- Mohamed Bousfoul is head of the department of irrigation network management and drainage in the Office for Agricultural Development in the Tafilalet, and Mohammed Bourass is a rural engineer and IFAD consultant.

actions: (i) promoting adoption of partnership schemes involving various departments of the Ministry for Agriculture and users as regards the development of water resources and rehabilitation of irrigation infrastructure; (ii) increasingly involve the Regional Office of Agricultural Development of the Tafilalet (ORMVATf) in providing supervision and technical backstopping to the WUAs and (iii) encouraging use of water-saving irrigation strategies.

4- During the four years of project implementation and while aiming at introducing new methodology and a new approach to prompt farmers to contribute to ensuring durability of irrigation infrastructure, the project has been able to reach almost all of the goals set down: (i) organizing and training farmers within the context of their WUAs; (ii) enhancing awareness by means of training courses and field trips; (iii) promoting water-saving irrigation strategies through practical demonstration plots and acquisition of logistics support; and (iv) setting up a database for follow-up evaluation of the WUAs' performance.

I. INTRODUCTION

1- Tapping the full potential of the biophysical environment is impossible without human resources availability. Indeed human resources do exist in the rural world, and are characterized by features such as the physical ability to discharge work properly, their indigenous know-how and resilience in adversity, innovative capacity and a rich cultural background.

2- Another important basic force factor of the rural world lies in its associative capacity. The latter is part and parcel of a strong and everlasting social tradition, i.e. the village-based jmaa (or traditional form of community organization) which has shouldered among many other things the role of water users associations for irrigation purposes. Real life experience has clearly demonstrated that as soon as the forces of associative capacity are pooled and unleashed, surprising results can be obtained. Today, the wealth of accumulated field experiences is vast and varied. The associative movement is witnessing an increasingly spiralling development pattern resulting in the formation of associations which are quite active in contributing to local development.

3- The various rural development projects carried out in Morocco by the International Fund for Agricultural Development (IFAD) have always focused on achieving the strategic goal of improving capacity-building of management and enhancing local development of poverty-stricken populations in mountainous areas, with a view to increasing their incomes, standards of living and ensuring food security, together with the overriding preoccupation of sustainable use of natural resources.

4- Indeed, this objective dovetails with the " 2020 rural development strategy ", put in place by the Ministry of Agriculture, Rural Development and Marine Fisheries, which aims at implementing a participatory approach to involve the population of the douars (villages) in matters pertaining to soil analysis, stock-taking of assets and constraints, identifying and prioritizing actions to be performed and managing them along the lines put forth by a participatory approach.

5- Actually among the projects implemented by IFAD in Morocco is the Rural Development Project in the Tafilalet (PDRT[1]). The Tafilalet is located South-east of Morocco, in the pre Saharan, south-of the Atlas mountains zone and extends over an area of 77 250 km2, of which 60 000 ha are under irrigation. The region encompasses four river watersheds: the Ziz, Ghéris, Guir and Maîder. It is divided into three major units: a mountainous slope on the southern piedmont of the calcareous eastern High Atlas in the north; an intermediate pre-Saharan region made up of highlands strewn with oases and a Saharan high plateaus region in the south .The area is known for its natural constraints particularly with regard to an arid climate, a flood and desertification prone area with real threats to the irrigation infrastructure impacting negatively on productivity of the cropping systems in use. However, the area can take advantage of assets such as water resources development schemes and irrigated crops.

6- As stated earlier on,the PDRT seeks to achieve the following set goals: i) increasing crop yields by improving irrigation efficiency; ii) increasing acreage under irrigation; iii) increasing productivity of collectively-used rangelands, while contributing to ensure environmental protection; iv) protecting villages and irrigation networks against sand-dust storms; v) building rural facilities and vi) promoting gender equity in economic and cultural development .

7- The total project cost is estimated at USD 30,02 million, financed by an IFAD loan of 11,8 million Special Drawing Rights (SDRs) (16,45 million USD), an IDB loan of USD 7,04 million . The Government's contribution totals approximately USD 5,63 million. Beneficiaries have contributed USD 0,90 million in the form of labour . The irrigation component represents 69 % of the total cost of the project.

8- During a mission carried out in the area by experts from the International Fund for Agricultural Development (IFAD), it was deemed necessary to undertake actions to upgrade users' capacities to deal with management of irrigation infrastructure. Based on the results of the mission, plans of the research project for the improvement of participatory irrigation management were developed and implemented.

9- The current document is a progress report on the research project for improvement of the participatory irrigation management. After a brief overview of the project (in terms of goals, components and implementation strategies), the results and achievements are presented. Conclusions and recommendations are put forth.

II. PRESENTATION OF RESEARCH PROJECT FOR IMPROVEMENT OF PARTICIPATORY IRRIGATION MANAGEMENT.

A. AIMS.

10- The project which has benefited from an IFAD donation[2], aims to put in ballast the prerequisites to make it possible for users to upgrade their capacities pertaining to:

1- PDRT is financed by the Government of Morocco, The Islamic Bank for Development (IDB) and the International Fund for Agricultural Development (IFAD

2- The project is jointly financed by ORMVATf, through making staff and facilities available to the project, and by IFAD through a donation of $US 490.000.

(i) getting organized within the structure of an association to deal with water resources; and (ii) meeting operation and maintenance costs of irrigation systems.

11- A pilot action plan has been implemented in two small-scale irrigation systems falling within the scope of action of the Tafilalet Rural Development Project (PDRT). The project has targeted two localities Jorf and Tinjdad where the problem of water scarcity is most acute. The plan is based on the following three basic actions: (i) promoting adoption of partnership schemes involving various departments of the Ministry of Agriculture and users as regards the development of water resources and rehabilitation of irrigation infrastructure; (ii) increasingly involve the Regional Office of Agricultural Development of the Tafilalet (ORMVATf)[1] in providing supervision and technical backstopping to the WUAs and (iii) encouraging use of water-saving irrigation strategies.

B. IMPLEMENTATION STRATEGY.

12- In order to achieve the set goals stated earlier on, the following courses of action have been followed:

(i) ORMVATf engaged in consultations with irrigation system users in the area to gauge their predisposition to take part in the program. The consultations were used as a platform to shed light on the program goals and the criteria underpinning the participation of grass roots populations. On the basis of results accruing from these consultations, geographical units were identified in joint collaboration with IFAD;

(ii) ORMVATf helped to organize users in associations according to the type of irrigation resource available: *khettaras* (underground galleries)[2] allowing storage and transport of inflow water from aquifers located several kilometres away from the irrigation system, also from wells and floodwater for combined use of these resources;

(iii) The IFAD/ORMVATf working group took part in the workshop hosted by Bari, Italy from 12-16 June, 2000. It finalized the project action plan and identified the course of action for its implementation;

(iv) ORMVATf in joint collaboration with IFAD organized a workshop and a study tour program for staff in charge of the Participatory Irrigation Management (PIM), the WUAs' members and farmers with a view : (i) to developing a common understanding of the goals pursued by the program; (ii) facilitating training and orientation on regulatory and procedural measures in force; and (iii) providing assistance to ensure promotion of co-operation and conflict-management mechanisms in the field of PIM;

1- The Regional Office of Agricultural Development of the Tafilalet (ORMVATf) is a regional structure of the Ministry of Agriculture, Rural Development and Marine Fisheries in the area of Tafilalet.

2- It is a system which has been cleverly engineered and is well- developed in the arid regions of Morocco and Algeria; it is also known in Central Asia (i.e. Iran...). Khettara, originally from Iran and is known as "Qanat" is a traditional mechanism for harvesting underground waters and introduced into Morocco by Arabs in the 12th century.

(v) The study trips abroad were prepared in such a way as to give a chance to all participants to benefit from the experiences of other countries in the field;

(vi) Reinforcing the unit in charge of PIM through creating a multidisciplinary team made up of community-based organizations, communication and management workers as well as agents with expertise in the technical specificities and in the social magnitude of the irrigation systems peculiar to the area;

(vii) Implementing an institutional development programme for WUAs and ORMVATf employees to allow them to upgrade their skills in planning, assessment and financial management of projects and improvement of irrigation water efficiency.

(viii) Also implementation of a follow-up evaluation system of the program: (i) to monitor users' participation rates in management of irrigation systems ; and (ii) to study the impact of this integrated approach on irrigation systems efficiency in the project areas;

C. PROJECT COMPONENTS

13- The major project components are: (i) promoting awareness building, organizing and establishing associations; (ii) supporting NGOs in their efforts to ensure operation and maintenance of irrigation infrastructure; (iii) equipping demonstration plots with drip irrigation; (iv) organizing study tours and training courses; and (v) acquiring logistics support

III. PROJECT ACHIEVEMENTS

A. BUILDING AWARENESS, PROMOTING ORGANIZATION AND ESTABLISHMENT OF ASSOCIATIONS

14- CIHEAM, Bari, Italy, provided technical support for project implementation through organizing workshops, orientation missions and consensus-building. ORMVATf ensured project monitoring and implementation by calling upon national experts when needed: (agreements with the Horticultural Complex of Agadir of Hassan II Institute of Agronomy and Veterinary Sciences (IAV), the Office of Co-operation Development (ODCO) and the Office for Vocational Training and Promotion of Employment (OFPPT)).

15- Awareness-building and training campaigns provided for within the project framework were carried out totally. On the whole twenty-one training courses were administered and their breakdowns are as follows:

(i) Two awareness-building sessions involving 31 associations and co-operatives which fully endorsed the project and agreed to sign a management contract;

(ii) Three follow-up workshop sessions organized in Bari and two training sessions on accounting;

(iii) Two institutional and organisational training courses aiming at strengthening capacity building of WUAs' in institutional and organisational areas to improve their management skills;

(iv) Seven technical training sessions to promote irrigation water-saving strategies; and

(v) Six training sessions on computer-based techniques: (Excel, Access and Autocad).

B. SUPPORT TO NGOS FOR ENHANCING PROTECTION OF IRRIGATION INFRASTRUCTURE

16- This action aims to support WUAs to protect and take ownership for irrigation infrastructure. Two agreements were signed and carried out:

(i) The first agreement pertains to digging and equipping a well with a motor pump for drip irrigation: 700 ml pipe in addition to a network of calibrated hydraulic nozzles for biological protection against sand dusts of the Guefifat flood water canal spill;

(ii) The second agreement consists in purchasing two cisterns to the Tinjdad NGO for irrigating plantations intended for protecting irrigation infrastructure in the Tinejdad irrigation system;

17- Two other agreements are being implemented. They target the rehabilitation of inlet gates in Tinjdad and irrigation networks in Jorf. The agreements are scheduled for implementation within the framework of the budget allowance of IFAD donation.

C. EQUIPPING ON-FARM DEMONSTRATION PLOTS WITH DRIP IRRIGATION

18- Infrastructure deployment and equipment of on-farm demonstration plots has concerned equipping five farms with drip irrigation using water from pumping stations (2 in Tinjdad and 3 in Jorf). As regards khettaras, equipment of 2 farms was performed through construction of a geomembrane storage pond capacity of 2000 m3 and setting up a drip-irrigation network for optimizing water rights from khettaras.. Within the project framework, the total acrea equipped with drip irrigation amounts to 10 hectares.

D. ORGANIZING STUDY TOURS AND TRAINING SESSIONS

19- The study tours and training sessions scheduled by the project were intended to help farmers and technicians to have access to and share experiences with similar associations operating in irrigated systems using state of the art water-saving strategies. Thus, 3 in-country field trips (lasting over 12 days) were organized to the irrigation systems of Moulouya (North-eastern Morocco), Haouz (Center-southern) and Souss Massa (South-western) involving150 people (WUAs'members and technicians affiliated with ORMVATf).

20- A trip was also organized to Valence in Spain for 2 presidents of WUAs, 4 farmers (who were provided with drip irrigation implements by project), 2 directors of the centres for agricultural development, one coordinator of the subdivision activities of Goulmima and an officer in charge of WUAs' follow-up unit.

21- These field trips made it possible for participants to draw benefits from home-grown experiences as well as from those of foreign countries as regards participatory irrigation management and water-saving strategies.

22- In addition, during project implementation period, four workshops were organized:

(i) A project start-up workshop to address issues related to creating appropriate conditions for better participatory irrigation management;

(ii) Three other follow-up workshops were convened to accommodate project implementation: (i) Tunis from 28/02/04 through 3/03/2004; (ii) Cairo from 15/02/2005 through 17/02/2005; and (iii) Morocco from 30/05/05 through 3/06/2005.

23- During the workshops, previous achievements were surveyed and proposals for approval of the program for the following year were tabled.

E. FOLLOW-UP EVALUATION SYSTEM:

24- A database for conducting follow-up evaluation of participatory irrigation management was developed with project support. Setting –up of database was carried out in the subdivisions of ORMVATF. Data processing is underway.

F. ACQUISITION OF LOGISTICS SUPPORT:

25- To ease implementation of project work, four vehicles in addition to computer and audio-visual equipment were purchased.

IV. RESULTS AND PROJECT IMPACT

26- Thanks to the efforts made within the framework of the project, a very positive impact was recorded with regard to three main aspects.

A. ORGANISATIONAL ASPECTS OF FARMERS CLUSTERED IN ASSOCIATION OR COOPERATIVES:

27- The number of farmers targeted by the project amounts to 13. 200. They are organized in 20 associations and 10 water pumping co-operatives. The table below shows the membership of WUAs.

	Jorf	**Tinejdad**	**Total**
Number of prospective members	8. 107	5. 080	13. 187
Membership	5. 685	2. 914	8. 599
Membership percentage	70 %	57 %	65 %

28- About half (15) of the 30 WUAs are regularly active. One third (11) of the WUAs still face some organisational problems- problems which yet are not a major hurdle to their being operational. 4 WUAs (13%) are confronted with operation difficulties.

B. NATURE OF USERS' CONTRIBUTIONS TOWARDS IRRIGATION INFRASTRUCTURE REHABILITATION.

29- The most striking impact of the development of WUAs is reflected through their large-scale contribution towards rehabilitating and maintaining the irrigation infrastructure initiated by ORMVATF. This is also illustrative of the reorganization and approval made of 30 WUAs within the two areas targeted by the project. These have become partly responsible for a variety of maintenance activities and for settling conflicts for ensuring efficient water management.

30- The users' contribution towards maintenance of irrigation infrastructure is one of the aspects worthy of consideration. This contribution is provided through labour. The table below shows the financial value of WUAs' contribution in rehabilitating irrigation infrastructure.

	ORMVATaf (in 1000 hectare)	WUAs (1000) Dirhams
Diversion weirs	10	12.8
Main canals[1]	69.6	152.5
Khettaras	51	145
Pumping stations	135	52.2
Sand control	981.4	386
Aggregate total	1247	784.5
%	62	38

C. NATURE OF IRRIGATION IMPROVEMENT TECHNIQUES

31- Farmers running the demonstration plots expressed their satisfaction regarding the introduction of this new irrigation technique (i.e. drip irrigation) into the targeted areas. Irrigation is mainly associated with market gardening crops which is viewed as a highly beneficial short- term type of farming. The long-term objective is to use drip irrigation for date palms and other adjoining key cash crops.

32- The water savings made through the newly- introduced irrigation pattern (i.e. drip irrigation) enabled farmers: (i) to grow two or three crops per year; (ii) to expand cropping to involve previously insufficiently watered plots using the conventional

1- Users take full charge of maintenance of secondary and tertiary canals.

irrigation system (i.e flow irrigation); (iii) to sell excess water to the khettaras; and (iv) to decrease water pumping from wells, therefore contributing to ensure stability of the water table.

33- The total acreage of demonstration plots equipped through project support is 10 hectares. Fully convinced of the benefits accruing from drip irrigation, farmers took the initiative to equip their farms at their own expenses. Over a two years' period, 12 additional hectares of acreage currently under equipment with drip irrigation by farmers will be made available, amounting to a 120 % increase through project gradual support.

34- The project has impacted positively on the area. The table below shows the evolution pattern of drip irrigation:

	Area outfitted in 2002 (ha)	**Area outfitted in 2004 (ha)**	**Area currently being outfitted (ha)**	**Expressed requests (ha)**
Total	119	285	412	909

D. A Sample of Achievements Recorded by some Farmers

35- The table below shows a sample of some of the accomplishments performed by some farmers

Farm n°	**1**	**2**	**3**	**4**	**5**	**6**
Rural commune	F.Oulia	F.Oulia	Fezna	Jorf	Jorf	Hanabou
Cropped acreage (ha)						
Total	8	22	8	13	6	4,5
Outfitted by projet	1.8	1 9	1 .7	1.25	1.16	2.5
Outfitted by farmers		9.5	2.5			
Outcomes						
Water savings	50%	40%	60%	70%	40%	60%
Labour savings	85%	80%	90%	60%		65%
Imrovement in productivity	60%	50%	80%	75%		65%

36- Thus, after two years' training and experimentation, we have noticed the following features:

(i) Farmer n°1 was able to set up his own nursery to produce good quality plantlets which he distributed to farmers in the area;

(ii) Farmer n°2: Being persuaded that localised irrigation is advantageous, he proceeded to gradually outfit 9. 5 ha acreage at his own expenses.

(iii) Farmer n°3 bought and outfitted 2. 5 ha, in addition to producing plantlets. His aim is to equip and crop a 6 ha acreage with high quality date palms and other key cash crops.

V. CONCLUSION AND RECOMMENDATIONS:

37- After four years of program implementation, and while still focusing on introduction of a new methodology and an approach for involving farmers in securing the durability of irrigation infrastructure, the project can boast of accomplishing the goals set down: (i) organizing and training of farmers within the framework of their WUAs; (ii) raising their consciousness through training and study trips; (iii) improving irrigation water management through setting up demonstration plots and purchasing logistics support; and (iv) setting up a database to be used in the follow-up evaluation of WUAs' performances.

38- The experience gained by all partners, i.e. ORMVATF (project team members and staff), NGOs and WUAs as regards implementation of participatory irrigation management and water-saving strategies, will be generalized to cover the whole of ORMVATF area and will certainly have a positive impact on water management policy at the scale of the region.

39- However, because of some shortcomings in terms of implementation of follow-up evaluation and in terms of capacity building of the co-operatives and associations, a consolidation programme in the form of a research-oriented development project is deemed necessary – a project geared toward:

(i) Pursuing the project action plan related to water- saving strategies, particularly from *khettaras*, the pumping stations through use of storage basins.

(ii) Consolidating water demand management (i.e. through technical and institutional measures and through capacity building of technicians and farmers);

(iii) Designing effective strategies for the management of the water tables and *khettaras* that are subjected to inopportune uses through excessive pumping;

(iv) Seeking more effective ways to keep within an associative framework management of floodwaters and water from storage dams.

(v) Within water management issues, incorporating a research component on ways and means to integrate rural gender within association-based groups for increasing the returns on water in economic terms.

PRDA: A PARTICIPATORY METHODOLOGY FOR ANALYZING AND IMPROVING IRRIGATION PERFORMANCE: CONCEPTUALIZATION AND EXAMPLE OF APPLICATION IN KENYA

Philippe Lemperiere[1]

ABSTRACT

In Sub-Saharan Africa, agriculture is the backbone of the economy and employs approx 70% of the active work force. Rain-fed agriculture is largely dominant and agricultural production is increasingly vulnerable to erratic rainfalls and recurrent droughts. Although irrigation development is still in its infant stage in most countries and its performance remains largely below expectations of policy planners, it is believed it has a strong potential for rural development and economic growth.

The APPIA project is implemented in several countries in Sub-Saharan Africa. APPIA is a French acronym for "Improving Irrigation Performance in Africa". One of the major activities of the project was to develop and test in the field a participatory methodology for analysing and improving the performance of farmer-managed irrigation scheme. This methodology has been named PRDA for "Participatory Rapid Analysis and Action Planning of Irrigated Agricultural Systems". A manual published by IWMI and the FAO presents the details of the methodology.

The present document aims to illustrate the approach of the project in one of the APPIA countries. This paper first describes briefly the situation of smallholder irrigation in Kenya and the numerous questions regarding the performance of such schemes. PRDA is then presented and a case study of its application in one Kenyan scheme is given. In conclusion this paper suggests a set of recommendations for effective use of PRDA based on the lessons learnt in the African countries where it was tested.

This paper discusses the issues at stake at different level: government, Water Users Association and individual farmers for successful smallholder irrigation. It highlights the following key principles of the PRDA methodology:

- A systemic approach of irrigation management using a conceptual framework including irrigation technology; individual and collective farmers' practices, institutional and economic issues;
- Adapting Participatory Rapid Rural Appraisal tools to the specific context of smallholder irrigation;

1- Office for the Nile Basin and Eastern Africa, P.O Box 5689 Addis Ababa, Ethiopia, Tel: +251 116 463 215 ; Fax:+ 251 116 461 252, E mail: p.lemperiere@cgiar.org

- Establishing multi-disciplinary partnerships between farmers' organizations, engineers, agronomists, extension agents, economists, decision and policy makers;
- Acquiring a shared vision of irrigation management and of a long term sustainability of irrigation systems, including economic, social and technical perspectives;
- Promoting information, collective awareness and mutual learning processes amongst irrigation stakeholders.

Finally and based on the results obtained during the course of the APPIA project, the present document suggest that PRDA may be one tool to achieve successful participatory irrigation management that can be used by multi-disciplinary / multi purpose organization such as National Irrigation and Drainage Committees.

INTRODUCTION

In Sub-Saharan Africa, agriculture accounts for approximately 70 percent of the economically active population. In this part of the World, rain-fed agriculture is largely dominant and its productivity has been stagnating over the past forty years. Volatile rains, soil degradation together with continuous price depreciation of agricultural products on the World market explain the stagnation of rain-fed agriculture and the increase of rural poverty in Sub Saharan Africa.

Irrigation can significantly improve agricultural productivity and is unquestionably one option for economic development. However in the time of cost recovery, farmer-managed irrigation and increasing competition over the limited water resources, irrigation productivity and sustainability must be assessed with care.

It is now widely recognized that irrigation performance depends on managerial and technical capacities of the concerned communities as well as the nature of relationships between irrigation technology, institutions and economics. Hence the need for tools to understand the key factors of irrigation performance and establish partnerships with irrigating farmers and their organizations to provide them more effective and demand driven support services.

This paper relates to the experience of the APPIA project. This project was launched in March 2003. APPIA is a French acronym for Improving Irrigation Performance in Africa. ARID[1] ensures the project coordination for the West Africa component: Burkina Faso, Mali, Mauritania, Niger and Senegal; while IWMI (office for Nile Basin and Eastern Africa in Addis Ababa) implements the project together with national partners in Ethiopia and Kenya. The principal objective of APPIA is contributing to the development of a productive and sustainable farmer-managed irrigation in Sub-Saharan Africa. An important activity of the project has been developing and testing in all concerned countries a methodology named PRDA for "Rapid Diagnosis and Action Planning of Irrigated Agricultural Systems".

The present document aims to illustrate the approach of the project in one of the APPIA countries. This paper first describes briefly the situation of smallholder irrigation in Kenya and the numerous questions regarding the performance of such schemes. PRDA is then presented and a case study of its application in one Kenyan scheme is given. Finally this paper suggests a set of recommendations for effective use of PRDA based on the lessons learnt in the African countries where it was tested.

1- ARID: Association Régionale pour l'Irrigation et le Drainage based in Ouagadougou, Burkina Faso.

1. SMALLHOLDER IRRIGATION IN KENYA: ACHIEVEMENTS AND CHALLENGES

1.1. PRESENT SITUATION

At present Kenya has 105,000 Ha under irrigation for both smallholder and large commercial irrigation. As described in table 1, different types of irrigation systems have evolved in the country. Irrigation consumes approximately 75% of the available water resource of the country and covers about 2% of the total cultivated area (5.2 million Ha) and almost 20% of the irrigation potential estimated at 539,000 Ha. The agricultural sector contributes to 30% of the GDP, 56% if agro-based industries are included.

According to the Ministry of Water and Irrigation, smallholder irrigation schemes cover 62,000 Ha. It mainly consists of group-schemes (total area: 35,000 Ha) with gravity or pump water supply in which horticulture or rice crops are grown. In smallholder individual schemes (total: approx 11,000 Ha), the water supply is manual (buckets) or pump-fed (motorized or treadle pumps) from open water source and the production concentrates on horticulture crops. Centrally managed schemes (Total area: 16,000 Ha) are managed by public agencies but the process of management transfer to farmers is underway, water is abstracted by river diversion or pumping and rice is the predominant crop. In spite of such a relatively small contribution, it is believed that smallholder irrigation could play an important role in rural development, since it can potentially provide food security, income and employment opportunities.

Table 1: A typology of irrigation in Kenya

Type of scheme	Smallholder schemes			Commercial schemes
Sub-type	Individual schemes	Group-based schemes	Centrally managed schemes	–
Period of development	Rapidly increasing since the 1990s	1970s & 1980s	1950 - 1970	Rapid development in the 1980s and 90s
Number	--	About 1,000	10	--
Total area	About 11,000 Ha	35,000 Ha	16,000 Ha	43,000 Ha
Range of scheme size	0.1 – 0.5 Ha	10- 900 Ha	350 – 6,000 Ha	4 – 3,000 Ha
Average farm size per beneficiary	As above	0.25 – 1 Ha	1 – 1,5 Ha	--
Operation and maintenance	Individual farmers	Water Users Associations	Public agency (on-going transfer)	Private enterprise
Land tenure	Private	Private	Public with tenant farmers	Private
Source of funds	Farmers	Government or NGOs	Government	Kenyan and foreign investors.

Currently irrigation development is led by the private sector: smallholders and investors who supply the domestic market and export horticulture products to the European Union. Kenya has thus become since 1999 the first flower exporter to the European Union. Factors identified to have contributed to the success of vegetable, fruits and flowers production aside from favourable geography and climate are (a) improvements in transportation infrastructure, (b) Availability of low cost irrigation equipment such as pumps, (c) rapidly growing urban population, (d) an improved environment for private and international investment, (e) macroeconomic stability and realistic exchange rates and (f) development of international commercial links.

1.2. AGRICULTURAL AND ECONOMIC PRODUCTIVITY OF SMALLHOLDER IRRIGATION.

Yields are generally low when compared to FAO benchmark for Sub-Saharan Africa as indicated for some crops in table 2. Low yields result from a combination of factors: difficulty in sourcing inputs, poor access to credit, problems related to insecure irrigation water distribution, inadequate extension service and marketing risks.

Table 2: Examples of average yields in smallholder irrigation schemes in Kenya

Crops	Sweet potatoes	French beans	Cabbage	Onions	Tomatoes	Bananas	Rice
Average yield (range: t/Ha)	8 - 11	5-7	10-14	8-10	8 - 12	15 – 20 Per year	2-4
Benchmark (t/Ha)	15	10	25	25	30	40 Per year	6

Gross margin per Ha of smallholder irrigated horticulture (excluding depreciation of equipment and family labour) varies between 1,700 and 2,800 USD/Ha according to yields and type of crops grown. Thus irrigated horticulture is an attractive option for Kenyan farmers if compared to the competing rain-fed cultivation of maize where gross margins are about 570 USD/Ha. However, labour productivity remains quite low, 2 to 3 USD/family man-day, and quite comparable with labour productivity of rain-fed maize (2.70 USD/man-day) and daily rate of unskilled labour in rural areas (2 USD/day).

1.3. OPERATION AND MAINTENANCE (O & M)

O&M is the weakest link in smallholder irrigation scheme in Kenya. There are generally four causes to this problem. The fist one is poor feasibility, planning and design (especially choice of technology) of many irrigation projects. The second is the weak management structure and low capacity of Irrigation Water Users Associations. The third is shortage of funds because farmers are unwilling to pay the O&M fee because the service is poor or they have not seen clear benefits from previous payments. Finally the fourth problem is associated with siltation of canals due to poor management of river catchments.

1.4. ISSUES AT STAKE

The above raises a series of questions and demands investigation at three different levels.

- Government level
  - Policies and measures that accompany irrigation development: Extension services and research, design of training programmes, legal framework for water users association, input supply and credit, market information;
  - Improvement of preparation, design and construction of irrigation projects with a view to reduce costs and enhance benefits of irrigation development;
  - Irrigation cost recovery / subsidies policy or in other words to which extent can capital costs be covered by farmers' contribution;
  - Enabling economic environment for marketing agricultural production.
- Water Users Association (WUA) level
  - Formation of representative WUAs for negotiation with external players;
  - Capacity of WUAs for managing technical and financial aspects of operation and maintenance;
  - Operation & Maintenance charging system taking into account farmers' capacity to pay and cost recovery requirements.
- Farmers' level
  - Increasing productivity of cropping systems to make them compatible with a cost recovery approach of irrigation management or in other words so that farmers are able (and willing) to pay O & M fee;
  - Improvement of on-farm water management.

2. PRDA: PARTICIPATIVE RAPID DIAGNOSIS AND ACTION PLANNING OF IRRIGATED AGRICULTURAL SYSTEMS.

2.1. PRDA MANUAL

This paper gives only a synthetic presentation of the methodology. A manual (Van der Schans, Lempérière; IWMI-FAO-IPTRID 2006) explains in details and in a simple way how to carry out a PRDA. The manual explains the methodology in a practical manner. Chapter 1 is a general presentation. Chapter 2 summarizes the overall method and the different steps of its application. In chapter 3 the conceptual framework (the constituents of irrigation systems) is introduced. Chapters 4 and 5 give information for organizing a PRDA and some practical advices to conduct a PRDA. The tools to be used during PRDA are described in annex A. Finally in annex B, a series of Reporting Sheets are provided to write down and analyze results after fieldwork.

2.2. WHAT IS PRDA?

PRDA is an approach for analyzing and improving irrigation performance together with farmers. The diagnosis aims to identify the limiting factors of performance: irrigation productivity and sustainability. Action plan to improve performance can have three components: (a) increase capital investments and inputs, (b) improve organizations responsible for O&M, and (c) enhance individual farming skills.

PRDA methodology and tools are an adaptation of several participatory methods to the situation of irrigated agricultural systems:

- Rapid Rural Appraisal (RRA): rapid assessment according to criteria set by the researcher
- Participatory Rural Appraisal (PRA): facilitating discussion amongst farmers and sharing of information with and amongst farmers.
- Participatory Learning and Action (PLA): Farmers and researchers learn throughout the project cycle and use these lessons to engage in individual or joint action.

These participatory approaches are combined with existing methodologies for Benchmarking that have been modified to suit the scale and limited quantitative data availability of farmer- managed irrigation schemes.

2.3. TARGET PEOPLE AND ORGANIZATIONS

PRDA is primarily meant for extension organizations wanting to improve their services to irrigating farmers and their organizations. Combined results of several irrigation schemes can also be used to formulate more general policy recommendations. A PRDA team consists ideally of four people, but it may be smaller when dealing with small irrigation system. Team members should have different disciplinary background, for example: irrigation engineer, agronomist, economist and specialist of farmers' organizations.

2.4. OBJECTIVES OF PRDA

- Identify the main limiting factors of the productivity and sustainability of agricultural irrigated systems
- Evaluate extension services and other supporting services provided to farmers
- Identify interventions to improve performance
- Describe the main characteristics of selected systems in order to enable more extensive monitoring of performance in the future.

2.5. CONCEPTUAL FRAMEWORK

Irrigation performance results of interplay between irrigation technology, farmers' practices, institutional arrangements and economics. PRDA uses a conceptual model for irrigated agricultural systems to help classifying collected information in a structured manner and process it to make a diagnosis and propose sound solutions to improve performance. For PRDA four constituents are identified to represent an irrigated agricultural system.

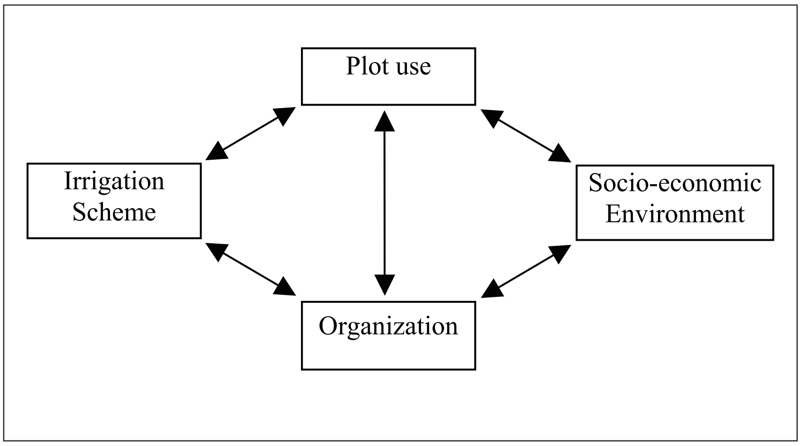


Figure 1: The four constituents of irrigated agricultural systems

2.5.1. Irrigation scheme

It is the physical system to convey and apply water to irrigated lands. **For PRDA, it is assumed that the type of technology strongly determines the manageability of the scheme by farmers and their organizations.** The constituent irrigation scheme can be seen as a sub-system with six constituents as shown in figure 2. On the left-hand side are the constituents that refer to the land; they should be consistent with each other. On the right-hand side are the "water constituents" that should be fitted to the "land constituents"; at each horizontal there is a close link between each "land constituent" and "water constituent" that should ensure the cohesion of the irrigation scheme.

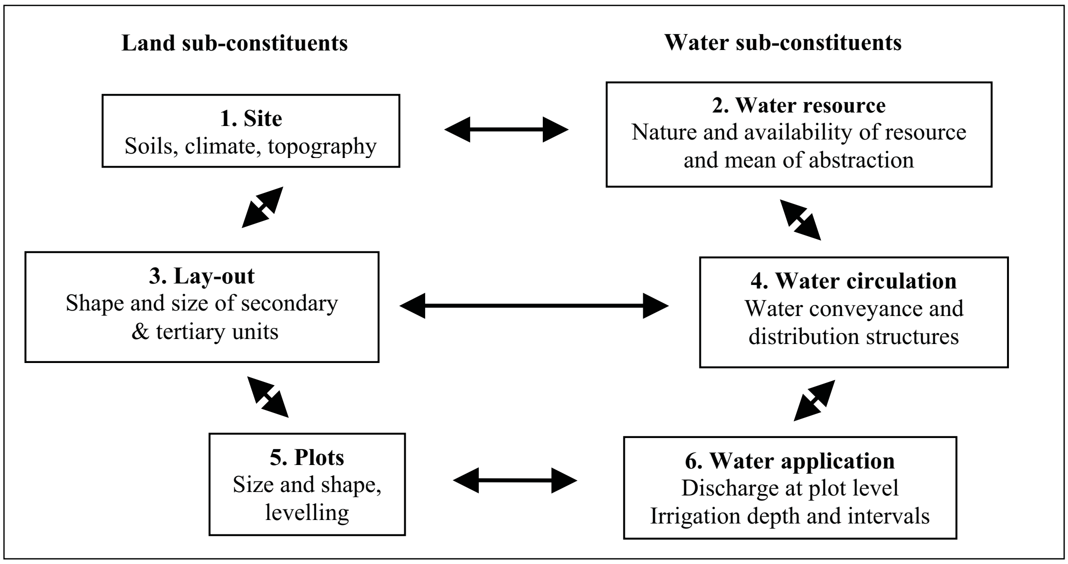


Figure 2: Sub-constituents of irrigation scheme

2.5.2. Plot use

This constituent includes all agricultural practices and production of irrigated plots. Usually decisions regarding plot use are made at household level in relation with other farming and not farming activities implemented by household members. Characteristics of "plot use" are the cropping system (type of crops, crop rotation and use of inputs, labour and farming equipment), land and labour productivity and farmers' income. PRDA does not seek to impose adoption by farmers of recommended practices such as ready-made "technology package" but rather highlights and explains the actual farmers' practices and seek opportunities for their improvement considering farmers' objectives, knowledge, skills and constraints.

2.5.3. Organization

Group-based irrigation systems imply an organization (e.g. a Water Users Association) of individual farmers who wish to undertake irrigation management related activities for their mutual benefit. For PRDA, analysis of organization involves the objectives or functions (water distribution, maintenance, planning of cropping seasons, etc.), the structure (members and organizational chart), assets (office, equipment), technical and managerial capacity to perform its functions and rules of the organization. Owing to the increasing complexity and dynamics of irrigation organisations, and to the increasing uncertainty of their economic environment, PRDA does not seek bringing ready-made solutions and one-way prescriptions or "recipes", but rather promotes effective and flexible tools and practices for technical, social and financial management.

2.5.4. The socio-economic environment

This is not exactly a constituent of irrigated agricultural systems but rather a range of relations between individual farmers and their organization with various organizations and individual, i.e. irrigation agencies, extension services, inputs providers, credit institutions, traders or cooperatives, etc.

2.6. PROCEDURE: A THREE STEPS APPROACH.

Figure 3 show details of the three steps of PRDA:

(a) Preparation: review of secondary data and consultation with farmers to seek their cooperation and with potential partner institutions that may assist in fieldwork, provide expertise and help implementing solutions);

(b) Diagnosis: collection of primary data using PRDA tools with farmers, assessment of performance, identification and ranking of constraints of productivity and sustainability and detailed analysis of constraints (causes and consequences);

(c) Action planning: Identification, assessment of solutions (their impacts, costs and benefits) and formulation of action plan.

It may not be possible to arrive at a well-structured action plan (including a logical frame) during PRDA itself, which takes less than one month. The action plan can also be finalized just before the next irrigation season with other potential partner institutions that could provide technical or financial assistance.

Table 3: Estimated time required to do PRDA on irrigation schemes of different size

Scheme size	10 ha	100 ha	1000 ha
Preparation	4 days	5 days	8 days
Diagnosis	6 days	8 days	13 days
Action planning	2 days	2 days	4 days
Total per person	12 days	15 days	25 days
Recommended team size	2 persons	2 to 4 persons	4 persons

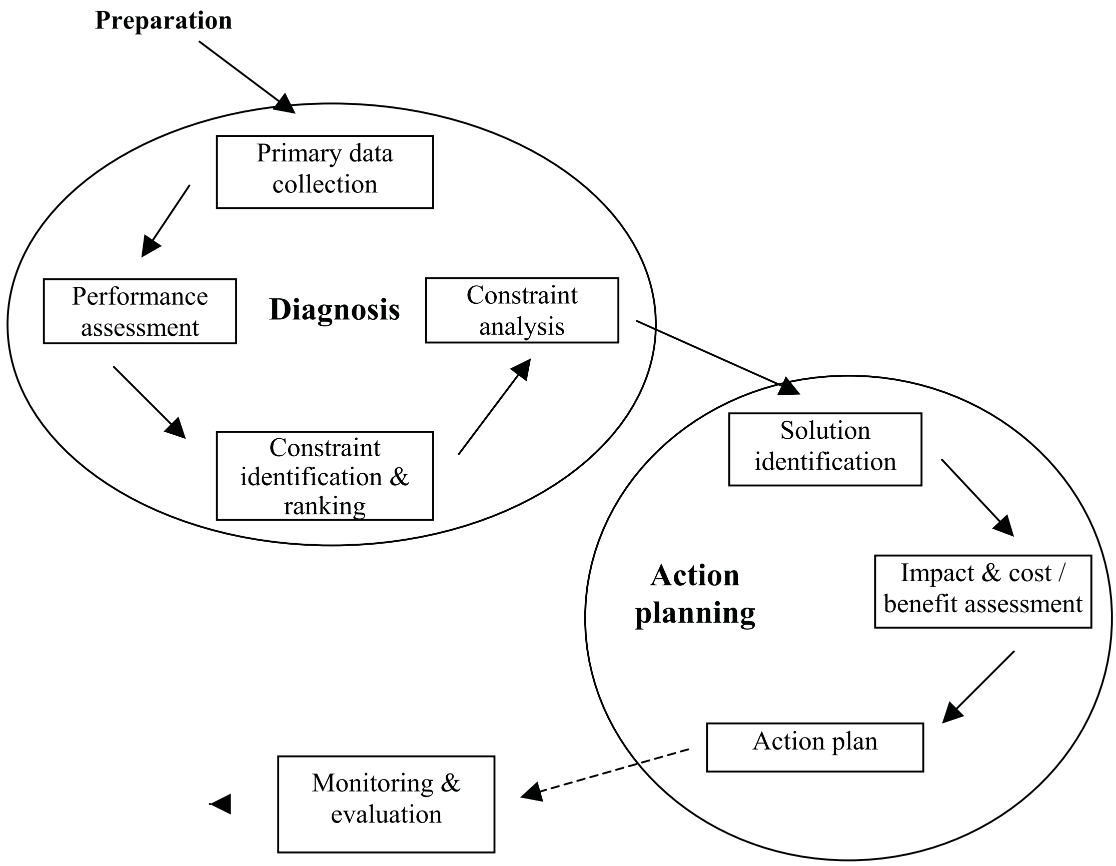


Figure 3: PRDA procedure

3. EXAMPLE OF PRDA APPLICATION IN MWEA IRRIGATION SCHEME, KENYA.

3.1. MWEA IRRIGATION SCHEME

The irrigation scheme is located at the foothills of Mount Kenya, about 100 Km to the Northeast of Nairobi. The irrigated area of 6,000 Ha supports a population of 4,000 farming households. Mwea is the largest centrally managed irrigation scheme in Kenya. It gets its water by gravity from two rivers originating from the watershed of Mt Kenya. Rice is grown for only one season per year. It uses the flooded paddy irrigation method.

The history of Mwea goes back to 1953 when it was developed under the British colonial government using captive Mau Mau (freedom fighters) labour. Soon after independence in 1963, the scheme was handed-over to the National Irrigation Board (NIB) a public irrigation agency. The NIB treated farmers as passive recipients of strict instructions regarding the management of the scheme and the role of farmers was limited to labour provision in paddy fields. There were quite a number of areas of conflict between NIB and farmers regarding cost of irrigation services (agricultural inputs and O & M fee) and absence of farmers' voice in the management of the scheme. These conflicts heightened in 1998 when farmers rebelled against NIB and their cooperative took over the management of the scheme in 1999. In the following years the scheme (and the cooperative) almost collapsed and in 2003, farmers and NIB reached an agreement. Under this agreement, a process of partial irrigation management transfer was initiated. It redefines the role of NIB to operation and maintenance of the major irrigation and drainage infrastructure and includes the formation of a Water Users Association. PRDA was conducted in 2004 to support the process of irrigation management transfer.

3.2. DIAGNOSIS

PRDA was carried out in Mwea in the fist quarter of 2004 by 2 NIB officers (irrigation engineers) a specialist of Farmers' organizations and an agro-economist from the ministry of agriculture. Inadequate water delivery at farm level was identified as the main constraint faced by farmers. As a consequence approximately half of the scheme stopped production and average paddy yield in cultivated area dropped from 5 to 3 tons / Ha. The diagnosis allowed making a comprehensive analysis of the causes of water shortage:

1- The flow of the two rivers supplying the scheme has been decreasing due to deforestation of the slopes of Mount Kenya (and perhaps climate change affecting East Africa). The intake work no longer makes it possible to supply the scheme during the peak irrigation periods. In addition irrigated area has been quickly increasing in the upper part of the watershed without real control by the Government authorities. Conflicts between Mwea farmers and water users upstream seemed inevitable if the Government pursues its "business as usual" policy or does not make investments aiming to increase the water resource.

2- High conveyance losses resulting of poor (quasi absence of maintenance); neither the cooperative or NIB was able to collect an O & M fee.

3- Absence of organized water distribution in the scheme
4- Poor on-farm water management: due to insecure water supply and absence of irrigation schedule, many farmers tended to irrigate their plots with as much water as possible when water was available and without considering actual crops water requirements to extent to which that approx 600 Ha were affected by water logging and salinity problems.

Such a diagnosis could have been made by a team of experts in a few days and without much consultation with farmers. Value added of PRDA was to favour information sharing, discussion, learning processes and collective awareness amongst farmers and between farmers and the evaluation team. Validation of the diagnosis by farmers was of crucial for the design and implementation of solutions.

3.3. ACTION PLANNING

Based on the diagnosis farmers and the evaluation team designed together an action to improve irrigation performance in Mwea irrigation scheme. Objective of the action plan was to improve and secure water availability within all plots by implementing the process of irrigation management transfer (IMT). Action plan for the IMT process included the following steps:

1- Formation of a Steering Committee for defining a strategy for IMT, the members were local government officials, NIB officers, elected farmers, representatives of the Ministry of Water and Irrigation and Ministry of Agriculture.
2- Organization of farmers meeting to discuss about issues and approve strategy for IMT.
3- Formation of the Water Users Associations (WUAs) and election of leaders by farmers: 62 WUAs at block level and an umbrella Association for the entire scheme.
4- Training of elected WUAs leaders.
5- Establishment of a water charging system for maintenance of main water infrastructure by NIB.
6- Development of WUA's By-Laws by all member farmers.
7- Starting of Operation of the WUAs.
8- Capacity Development of WUAs (offices, equipment, management tools, etc.)
9- Consultations between NIB and the WUA to find solutions to the water shortage problem.

3.4. RESULTS

Following IMT, The National Irrigation Board (NIB) has now been accepted to be a water service provider. It has improved the canal system through proper maintenance and collects the O & M fee. Farmers now maintain canals in the tertiary units.

Water shortage has also been alleviated through the implementation of a plan for staggered cropping: planting dates are now phased in fields / sections of the scheme. This planning is done by both the NIB and the WUAs.

New crops (soya, peas and maize) have been introduced by the Ministry of agriculture through demonstration plots belonging to voluntary farmers. They are planted immediately after rice is harvested. Thus the cropping intensity is increased.

Water shortage has also been alleviated through the construction of a water reservoir by NIB. This reservoir collects water from canals at night and during off-peak irrigation season. Stored water is then used for irrigation during peak water requirement periods. Construction of a second reservoir is planned.

Mwea umbrella Water Users Association has approached the local governmental authorities for the formation of a river-based Water Users Association to improve water management at the catchment level. As per today consultations of concerned players have been initiated.

Average paddy yields in the scheme are now 5.4 tons/Ha and almost all the command area was cultivated in 2006. The annual O & M fee for NIB service is 80 USD/Ha and represents 3% of the total value of production for the average yield; a level that seems quite acceptable to farmers since the recovery rate in 2006 was 95%.

3.5. LESSONS LEARNT

The case of Mwea irrigation scheme is now cited in Kenya as an example of successfull Irrigation Management Transfer, while a few years back the situation of the schemes seemed hopeless. However some conflicts remain between the NIB and the cooperative and between farmers and the cooperative. The main contribution of PRDA approach is very likely that it has helped a lot re-establishing a dialog and mutual trust between farmers and the NIB for redefining their respective tasks and responsibilities within the framework of Irrigation management transfer. Once again, information, discussion, learning processes and collective awareness are the key words for participatory irrigation management.

CONCLUSION

When compared to other participatory methodology, practitioners of PRDA in Sub-Saharan Africa have noted the high level of professionalism and special focus the method has on irrigation issues. The conceptual framework of the method is easy to understand. However, some practitioners found it difficult to understand the whole process. This may require the development of a training curriculum based on the manual and a greater attention to the educational background and experience of individuals when constituting PRDA teams.

Within an irrigation scheme, diverse strategies may develop, depending on each household's history, composition, objectives, and so on. When doing a PRDA, it is impossible to take account of each and every household's characteristics; however, it may be irrelevant to consider the scheme homogeneous. Hence we recommend adding to PRDA approach making a typology of farmers that groups households with similar strategies and characteristics. Such a typology should be of a simple and practical nature and focus on landholding size, land tenure and production and marketing styles.

Institutional stability is strong factor of success of PRDA. In Ethiopia frequent institutional change and staff transfer in extension and other supporting services to irrigating farmers has hampered the process and caused losses of information.

PRDA takes root in the context of smallholder irrigation scheme in Africa. It relies on a number of background principles, orientations and concepts among which it seems important to highlight the following:

- Establishing multi-disciplinary partnerships, meaning that farmers' organizations, engineers, agronomists, extension agents, economists, decision and policy makers have been involved in the process.
- Acquiring a shared vision of irrigation management and of a long term sustainability of irrigation systems, including economic, social and technical perspectives.
- Promoting information, collective awareness and mutual learning processes amongst irrigation stakeholders.

In Kenya, the APPIA project and PRDA approach raised a strong and sustained interest of various stakeholders (farmers, engineers, economists and policy makers) and offered a unique opportunity to do fieldwork collectively and in a multi-disciplinary manner. Technicians and policy makers realized that there was no organization in country that can address all issues related to irrigation management. Hence the Ministry of Water and Irrigation decided the formation of a professional association to enhance networking amongst irrigation players, implement multi-disciplinary approaches and develop further Research & Development programs. In countries where they exist this could be one role of the National Irrigation & Drainage Committees.

The 4th Asian Regional Conference & 10th International Seminar on
Participatory Irrigation Management
Tehran-Iran May 2-5, 2007

THE NECESSITY OF FARMERS PARTICIPATION IN CONSTRUCTION OF PRESSURIZED IRRIGATION SYSTEMS FOR PIM SUSTAINABILITY IN IRAN

H. R. Hejazi[1]

ABSTRACT

As a developing country, Iran has several large-scale irrigation and drainage networks under study and operation. These networks are often constructed in small-scale farmlands, and because of water deficit, inappropriate topography and incentive policies, they are equipped with pressurized irrigation systems in which operation is more complicated, comparing with surface irrigation method. On the other hand, government policy is to develop private sector and therefore transferring operation of the networks to farmers organizations is highly considered. Regarding considerable costs of project execution which is provided by public credits also bank facilities by farmers commitment establishing a sustainable PIM is highly important.

Nowadays, national policy is often accelerating construction in large-scale pressurized irrigation projects, as a result all components of pressurized irrigation systems being performed by government, so farmers do not play such an important role in this process. This theorem would cause some problems in transferring the irrigation system management to farmers organization.

In the present paper, the results obtained from performing under pressurized irrigation systems by government is compared with the one constructed by farmers organization, also offers some suggestions with regard to changing the present procedures and participating farmers organizations in project execution.

1- INTRODUCTION

Iran as a developing country has 250 mm precipitation, often with arid and semi-arid climates. There are irrigation and drainage systems in areas about 2 million hectares under study, planning and construction. Because of water resources deficit and inappropriate topography, most of the projects are equipped with pressurized irrigation systems.

On the other hand, having small-scale farmlands and the necessity of constructing an independent pump station and pressurized irrigation systems at usual areas of 100-300

1- Msc. In Irrigation and head of irrigation and drainage section of saman-abrah consulting engineers company Tel: 88681507, 88683975 fax: 88693074 e-mail:hrhejazi@yahoo.com

hectares, will result in an independent irrigation unit which involves more than 100 farmers. With regard to government policy after project execution, operation and maintenance of pressurized irrigation systems must be done by farmers organizations.

Now, the costs of constructing pressurized irrigation systems are provided by public credits and bank credit, so that farmers don't need to cash investment but they only must undertake to pay their loans. Project construction will be done by contractors which are selected by government organizations of provinces like agriculturel–jahad organizations. At the end execution, project will be transferred to farmers organizations. But some experiences show that if participation is consistently emphasized in all phases of the project, local people will increasingly become the owners of the changes they propose (Natasha van dijk1999) and farmers participation in construction can gain farmers a stronger basis for insisting that construction is done to good quality standards and using designs which better serve their needs(Bryan Bruns and Helmi 1996).

2- CONSTRUCTING PRESSURIZED IRRIGATION SYSTEMS IN AREAS WITH PERSONAL OWNERSHIP

Such a project in which farmlands belong to one farmer, if farmland owner tends to install a pressurized irrigation system, after a necessary examination and consulting with experienced experts he can choose an appropriate system, then after making a request to public organizations, they will start to design his farmland .According to costs of project, bank facilities with the progress of execution will be paid. Therefore, farmers will be involved in all phases from choosing irrigation system, designing, providing equipment until project execution.

At the end of project execution and obtaining O&M guideline, due to having enough information by farmers, he often can operate the system successfully.

3-CONSTRUCTING PRESSURIZED IRRIGATION SYSTEMS AT LARGE AREAS WITH SMALL SCALE FARMLANDS

In extended project with about a few thousands hectares areas and small-scale farmlands to constructing pressurized irrigation system, government organizations select consultant engineers to study and designing the project, so farmers will not be aware of the project details. Usually small-scale farmlands with areas about 1-5 ha, and the necessity of constructing an independent pump station in an area of 100-300 ha, will result in an independent irrigation unit which involves more than 100 farmers.

On the other hand, pressurized irrigation systems won't be operated until all canals, pump stations, main, sub-main and lateral pipelines are installed. Hence, for a prompt operation of soil and water resources, government undertakes constructing all parts of projects and farmers only will pay back the loan. In such conditions instead of small projects in which farmer is directly involved in choosing irrigation system, design, providing equipments and construction, in large scale projects which may include over 1000 farmers , these farmers wouldn't have determent role in project and usually these projects would be constructed uniformly for all of them.

In such projects, during execution, farmer organizations will be established by cooperation of government organization and consultant engineers. These farmers organizations, meanwhile settling down opponent farmers at construction phase and they will learn about irrigation system operation and maintenance, and after project execution accomplishment, the project will be transferred to farmers organizations. Thus because of farmers are not involved in construction, the operation phase will face some problems and may not achieve success.

The advantages and disadvantages of construction without farmers' involvement are:

A- ADVANTAGES:

1- By an intensive management, project execution will be performed rapidly and all project components including: pump stations, main, sub-main and lateral pipelines will be installed simultaneously and operation of project after that will be conceivable.

2- Due to supervision by expert engineers, the quality of equipment and project execution will be suitable.

3- Project performance is uniform through the farms.

4- In the absence of farmers, decision-making in construction would be easier and faster.

B- DISADVANTAGES

1- If farmers do not participate in construction they will be disappointed and inattentive about the system and this, in turn, may lead to some damages to systems during cultivation.
2- Since farmers don’t have enough knowledge about the irrigation system and are not involved in construction, in some of projects, they may not be interested in operation and project probably won't be operated completely.
3- Since the whole project is constructed in limited period, some problems and disadvantages of system regarding the region conditions and social affairs wont be identified.
4- Because farmer organizations don’t participate in construction phase, system maintenance by them will be difficult.
5- Since construction depends on government organizations, it may continue the dependency during operation phase and as a result it may delay irrigation management transfer.

4- CONSTRUCTION OF TOBA PROJECT IN SMALL SCALE FARMLANDS BY FARMERS ORGANIZATION (CASE STUDY)

In recent years, some projects were executed on small scale farmlands by farmers organization in Iran that one of them is **Toba project** in **Ben town,** Chahar mahalo bakhtiari province, south west of country, and its general specifications are as follow:

Area: 470 hectares

Water resource: Zayandeh rood river

Pumping head: 385 meter with 2 pump stations

Discharge: 188 lit /sec

Conveyance pipeline: 4 km steel pipe with 500 mm diameter

Crops: Almond and Peach trees

Irrigation system: Drip Irrigation

Numbers of farmers: 670 persons

Farmlands area for each farmer: 0.5 to 0.8 hectares

4-1-PROJECT EXECUTION

The project area, before construction belonged to Natural Resources Organization, which is transferred to Ben town people for job and occupation purposes. The project execution initiated in 1999 and finished in 2004. Haj Ali Akbar Salimi was involved in some contractors companies so he has valuable experiences. Hence he undertook the project construction and irrigation management as managing director of farmers organization and project is constructed directly by farmers organization.

Agri-bank started to pay the loan to the farmers organization gradually from 1999. and after 5 years farmers started to refund the loan and this will last for the second 5 years. In order to get the loan from bank, farmers should first pay 1300 million rails to farmers organization but just 280 million rials was paid by farmers and the rest were provided by farmers working on construction activity. Following to receive loan from bank, farmers began to purchase equipment and project execution. With farmers activity and their participation in construction also decreasing the costs, parts of money was saved in bank, so that some of installments were paid by these savings. In addition, for the last 3 years, costs of irrigation system operation are provided by bank interests of that savings.

4-2- OPERATION & MAINTENANCE

The operation of project started from 2004 .Farmers organization is on the basis of 6 parts. Each part includes 2 groups and each group consists of 54 farmers (farmers organization chart is given in diagram (1)).

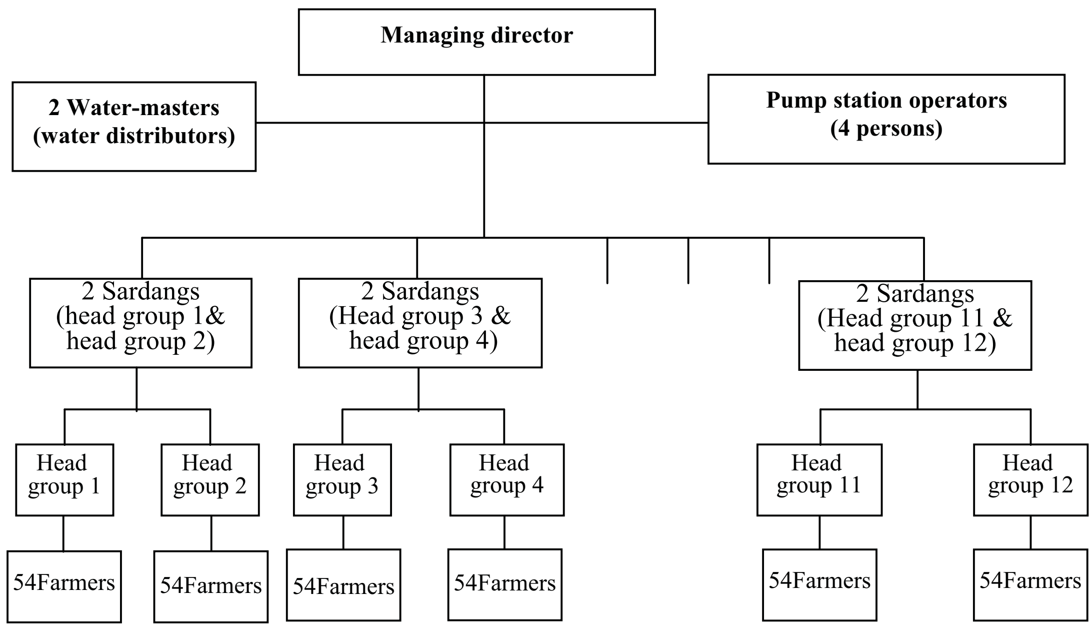


Diagram (1): operation chart of Toba

Irrigation is done by 2 water-masters (water distributors). Their job is controlling main and sub-main pipelines as well as opening and closing valves, but farmers are responsible for operation and maintenance of manifold and lateral pipes that are in their farmlands. Watermsters and pump stations operators are responsible for maintaining the main network, pump stations and filtration equipment. If some technical problems like electrical problems occur, they will call for active technicians in **Ben** town. Managing director and sardangs (the responsible person for each part of six parts is a sardang) will undertake accounting procedures.

The advantages and disadvantages of construction with participation of farmers organizations involvement are:

A-ADVANTAGES

1- Construction costs would be economical.

2- Economized construction costs will lead to saving money as farmers organization support.

3- Since government is not involved in project construction, the dependency of farmers organizations will decrease in operation phase.

4- If the project doesn't have a suitable prospect in farmers point of view, it won't be constructed. In other words, the presence of farmers in construction is a sign of PIM sustainability.

5- The presence of farmers at construction phase will increase their knowledge about operation and maintenance.

6- The cooperation of technicians with farmers organization during construction, will simplify solving technical problems which occur during operation and maintenance.

7- Farmers cooperation at project construction will reinforce the relationship between members and will inspire them to participate in collective activities.

8- The presence of farmers during construction leads to identifying active and committed people who can play effective roles in operation phase.

9- Farmers participation cause some changes in planning which, in turn, will result in the project be more adapted to farmers interests and desires.

B-DISADVANTAGES

1- The quality of equipment and construction will decrease because of not having a contractor and experienced supervisor.

2- The time of construction will be longer because of the necessity of farmers participation and their full acceptance.

5- CONCLUSION

As mentioned before, usually at pressurized irrigation projects in large areas which are constructed in small scale farmlands, all of the project execution are done by government and after accomplishment of project execution, will be transferred to farmers organizations. This issue will result in farmers irresponsibility, and it will, in turn cause their dissociation during project operation so that after transferring the system to farmers organizations, farmers will ascribe the organizations` managers to be responsible for all the system's problems.

5-1- THE PURPOSE OF CONSTRUCTING THE PRESSURIZED IRRIGATION SYSTEMS

It is presumed that final purpose is PIM sustainability of project. Whereas in large projects, often executing in short period of time is now the main goal and project operation is purpose defined in parallel with main goal also it will become more important when the project is approaching its final stages of execution. Therefore, these dilemmas will arise within the project:

- In order to achieve a time schedule and to accomplish the projects timely, there will be an attempt toward minimizing the need for arrangement with farmers.
- In order to accept project construction by farmers, it is necessary that a considerable part of construction costs be gratuitous. However in small projects in which people make the request for construction, financial support is less than the one in large projects

If farmers organizations are to be involved in executive procedures, some changes as the following will be necessary in order to achieve sustainable PIM:

1- 1-In order to encourage farmers to accept project construction, they should be well informed of irrigation system and operation procedures, for this purpose constructing pilots is inevitable and it is one of the priorities, also promoting activities as well as informing people will be done comprehensively.

2- 2-If the project be accepted by farmers organizations and if they must participate in project construction, the system should be accepted by the majority of farmers that will lead to changing the project layout according to farmers opinion and characteristics of farmers society.

3- Project execution by farmers organization will result in gradual on-farm system construction and the experiences achieved from last constructed areas, will improve the project execution in other areas.

4- 4-If farmers organization are constructing the on-farm irrigation system , it is necessary to use local contractors or train farmer organizations the necessary instructions that will lead to localizing the construction knowledge of pressurized irrigation systems.

5- In order to attract farmers interests and increase their motives to accept the project, economic sustainability will become more important, so that this will cause the companies, government organizations and research institutions give a special consideration to decrease the costs and increase farmers incomes which results in PIM sustainability.

Therefore farmers' participation will have positive effects in project construction and sustainability of PIM. There is no doubt that farmers participation should be precisely studied and the level of such cooperation should be on the basis of project`s conditions and characteristics of farmers society.

5-2-DIFFERENT LEVELS OF OPERATION AND MAINTENANCE MANAGEMENT OF PRESSURIZED IRRIGATION SYSTEMS

Before changing the execution procedures of pressurized irrigation systems, it will be useful to identify different levels of operation and maintenance management. At present, usually a rural producers cooperative company is established in farmlands in area of 1000-3000 hectares and that company is responsible for the management of irrigation and cultivation of the farmlands. At higher levels, water users association (WUA) or government organizations are involved but they are not related to the present paper. The lower levels of operation and maintenance management of pressurized irrigation systems are shown in diagram (2). It shows the responsibility of operation and maintenance in different levels:

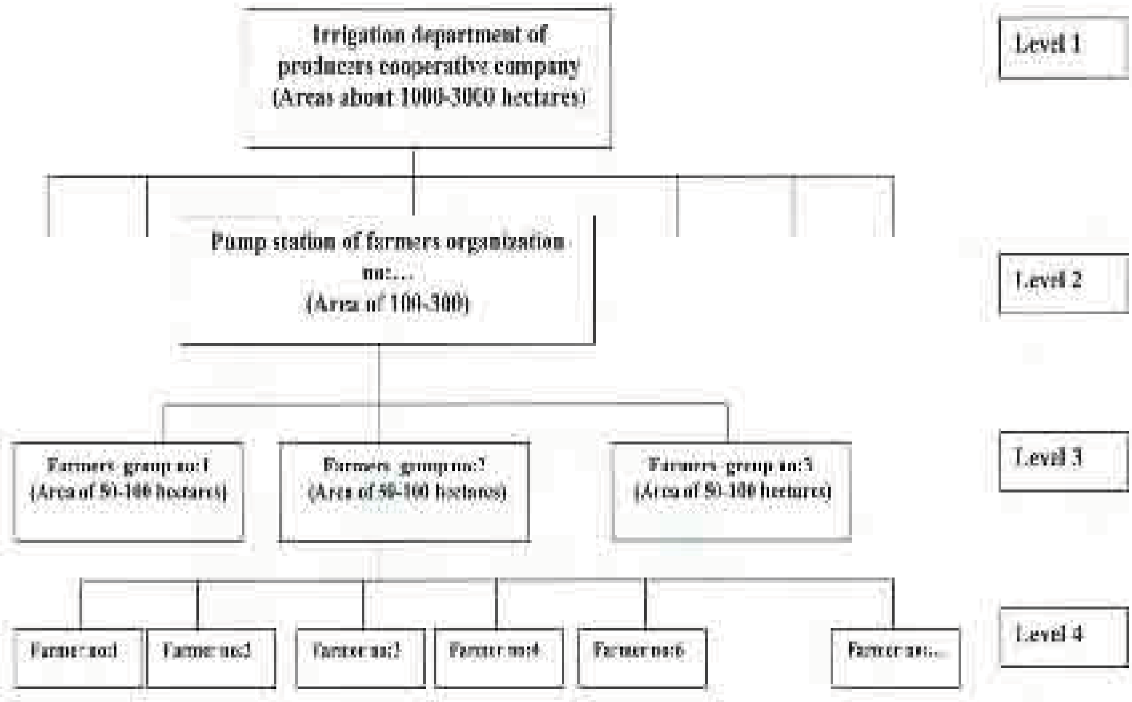


Diagram (2). A typical chart of operation organization for pressurized irrigation projects and different levels of operation and maintenance management

Level 1: irrigation department of the cooperative company is directly responsible for operation and maintenance of the main pump stations, reservoirs, canals usually in areas about 1000-3000 hectares.

Level 2: In farmlands areas covered by secondary pump station (usual areas of 150-300 hectares) a farmers organization will be established in which one person is responsible for this organization. This organization will be directly responsible for operation and maintenance of secondary pump station and main pipelines.

Level 3: It will be necessary to establish a group in covered farmlands with one or more sub-main pipelines in usual areas of 50-100hectares. And in each group, one person will be chosen as the group representative. Hence, in every operation organization covered by an independent pump station, usually there are 3-5 representatives of a group so that one of them can be chosen as organization undertaker.

Level 4: farmers will be in the fourth level of operation and maintenance of pressurized irrigation systems and usually the farmland area for each of them is 1-5 hectares.

5-3- CONSTRUCTING IRRIGATION SYSTEM AT FIRST AND SECOND LEVELS

Irrigation network in first and second levels includes main pump stations, canals, reservoirs, secondary pump station and main pipe lines. At present, it Is not possible for farmers organization to construct this part of system with proper quality, so it is better to continue the construction in these levels by experienced contractors and consulting engineers.

In this regard, the construction of main pump station, canals and reservoirs, should be arranged by producers cooperative company and farmers organization representatives, so they will be involved in project construction as much as possible.The employer should also inform them properly. Regarding the construction of secondary pump stations and main pipelines, in addition to producers cooperative company and the agents of farmers organization, the representatives of groups should be involved and contribute to the project as well.

5-4- CONSTRUCTING ON-FARM IRRIGATION SYSTEM IN THE THIRD AND THE FOURTH LEVEL

Irrigation system components at the third and the fourth levels include sub-main pipelines, manifold (in micro irrigation) and lateral pipes. In small-scale lands with very small areas, all of the pipelines even laterals will be constructed jointly and in a few farmlands, but in large-scale farmlands, only the sub-main pipe is jointly constructed.

Constructing this part of system have less complications, compared with the first and the second levels, and it will be possible to involve representative groups and farmers in planning. Diagram (3) offers a flowchart for on-farm pressurized irrigation system construction.

6- SUGGESTIONS

The participation of farmers in constructing the project may result in PIM sustainability, for this reason, the necessary laws should be approved, also the extent and method of participation of farmers organization should be studied in every project by consulting engineers.

Changing the construction procedures as well as farmers participation in constructing the pressurized irrigation projects in short term, will slow down the construction and defer initiating the project operation, however, farmers participation in long term leads the farmers creativity, attitudes, energy and their machines and equipment, into a suitable way and use them for developing the project purposes.

The important issue in constructing on-farm irrigation system by farmers organizations, is observing the standards and qualification measurements in providing the equipment as well as constructing the project, for this purpose, the necessary guidelines and supervisions should be available.

To inform the boundaries of the areas covered by each secondary pump station and sub-main pipelines to farmers

⇩

To constitute groups, and choosing groups representatives and organization's undertaker by farmers

⇩

To introduce groups and organization representatives by cooperative company to government organizations

⇩

To announce the farmers readiness for on-farm irrigation system construction

⇩

To make necessary arrangement between cooperative company and government organizations in order to accept construction of the project

⇩

To allocate the necessary credit by government organizations

⇩

To make decision for project construction method by farmers organization

(construction by farmers, contractor or both)

⇩

Providing the necessary equipment and on-farm irrigation system execution

⇩

Supervising the executive operation by government organizations and approving the construction quality

⇩

Paying the costs in proportion with equipment provisions and progress of construction by bank

⇩

Testing and starting the system by farmers organization and obtaining the water right from government organizations if there is not any technical problems in system

Diagram (3): Suggested flowchart of constructing phases for on-farm pressurized irrigation system by farmers organizations

REFERENCE:

1. Natasha van Dijk. 1999. Interaction for irrigation: how analysis guided a construction project in Peru. PLA Notes(1999),Issue 34,pp.37-42.
2. Bryan Bruns and Helmi. 1996. Participatory irrigation management in Indonesia: lessons from experience and issues for future. Electronic learning guidebook for participatory irrigation management, 1997: 1-24

DRIVING AND RESTRAINING FORCES IN IMPLEMENTING PARTICIPATORY IRRIGATION MANAGEMENT IN THE LITERATE STATE OF INDIA

George Chackacherry[1], K Madhavachandran[2]

ABSTRACT

Kerala, elongated coastal state of India, lags behind many states in the country in participating farmers in the management of irrigation, and implementing PIM. It has no rich tradition in community management of irrigation, may be due to rich water resources it enjoyed (annual average rainfall 3000 mm). Government manages the irrigation projects and distribution of water to its 0.3 mha irrigated area, which includes wetland crops like rice, and garden land crops like coconut. Fragmentation and subdivision of land and resultant small size of holdings (average 0.3 ha); part-time cultivation of farmers who are literate (literacy rate 91%); lack of sufficient labour availability and high labour cost; and lack of coordination among various departments are the major threats to irrigated agriculture in Kerala. PIM pilot projects being implemented at Neyyar and Malampuzha Irrigation Projects of the State have shown that, in spite of all the above issues, farmers are highly motivated and are ready to share responsibilities of PIM. Since spouses of farmers are also inducted as members of WUAs, enthusiasm shown by women in managing irrigation is encouraging. Preference ranking of institutions to manage operation and maintenance (O&M) under different water availability conditions, carried out at the pilot project area through Trade-Off Method, shows that majority of the farmers have given preference to WUAs to manage O&M under both ways, as well as sometimes adequate, timely and equitable water availability conditions. The pilot project experiences are also encouraging. But the hesitation of officials to depart from the existing system, the reluctance of operational staff to involve users in management, and lack of legislative backing, are the main blocks noted.

1- Scientist & Officer in Charge, Centre for Water Resources Development and Management (CWRDM) Sub Centre, Trivandrum, Kerala State – 695121, India Tel.& Fax: +91-471-2222319;
Mobile: +91-9446404780; email: g_chakkacherry@eth.net
2- Scientist, Water Management Division, CWRDM, Kozhikode, Kerala State – 673571, India

INTRODUCTION

Kerala State is one of the smallest states of India located at the southernmost tip of the Country. It lies between 8° 18 ' and 12° 48' North Latitude and between 74° 52 ' and 77° 22 ' East Longitude, with a geographical area of 38,863 km^2. The State is a narrow stretch of land 566 km in length. The settlement pattern is linear along roads and water ways, and the typical village dwelling is not seen in Kerala. Due to this fact, the State is called as an 'elongated village'. Though no distinct urban-rural dichotomy is found, now urban values have strong hold in the State. Better transportation facilities, educational status, and income from abroad (Remittances from Keralites working abroad, mainly in the Middle East, make up over 60% of the state's gross domestic product) are believed to be the reasons for this situation. The total population of Kerala is about 318 lakh, with a density of 819 persons per km^2 (national level it is 324 persons). Women outnumber men in the State. The sex ratio is 1058 females per 1,000 males. Literacy rate of the State is high compared to all other states of India. When the national literacy rate is 65%, in Kerala it is 91%. Striking difference is not found with regard to the literacy rate of male and female in Kerala; it is 94% for male and 88% for females; whereas it is 76% (male) and 54% (female) in the national level (Census Report, 2001).

Although Kerala accounts for only 1.18% of the land surface of the country, her water potential accounts for 5.4%. The State receives an average annual rainfall of 3,000 mm; it is bestowed with 44 rivers and several lakes and ponds. However, 60% of the rainfall in this humid tropical region is received during the south-west monsoon (June-August), 25% during the north-east monsoon (September-December) and the rest 15% during the non-monsoon period (January-May).

The net area irrigated (20% of total farming area) from all irrigation sources in Kerala works out to 3.81 lakh hectare (ha), out of which the contribution of major/medium irrigation projects is about 3 lakh ha. Rice is the main crop cultivated in the command areas of irrigation projects. Except one project, all others are designed for irrigating wetland crops, mainly rice. However, the area under upland (garden land) cultivation under irrigation is increasing tremendously in almost all the irrigation projects. For example, in the Neyyar Irrigation Project, it is estimated that 70% of the irrigated command area is occupied by upland crops (GoK, 1990). Most of the lands here have been reclaimed to cultivate coconut. Within a period of 15 years from 1980-81, the proportion of area under rice declined from 27.79% to 16.51%. During the same period, the area under coconut increased from 22.58% to the 29.88% (Thomas, 1999). The average land holding size in Kerala is only 0.33 ha, whereas it is 1.68 ha at the national level. More than 90% of all the holdings are below half hectare in size. However, the State is predominantly an agriculture state where more than 60% of the population is engaged in farming and the processing of agricultural produces. For India, Kerala is the main producer of perennial crops such as coconut, rubber, black pepper and areca.

COMMAND AREA DEVELOPMENT AND PIM

Kerala has no rich tradition in the management of irrigation systems by farmers, though farmer-managed traditional systems are present in various parts of the country, for hundreds of years. This may be due to the better availability of water resources in

Kerala in the past, which might not have encouraged community action for irrigation management (Chackacherry, 1995). Though the command area development (CAD) programmes started in Kerala during 1980, the activities gained momentum only after 1986. According to the CAD Act 1986 (GOK, 1986), the 'beneficiary' farmers of one or more outlets, ordinarily an extent of about 40 ha of command area, have to form together a beneficiary farmer association for looking after the operation and maintenance (O&M) of sluices and field channels, and distribution of water to the command area. Accordingly a total of 4,011 associations were formed in the 16 project commands till the end of March 2005 (CADA, 2006).

As reported by several studies, CAD Authorities (CADAs) in various states of the country, though was envisaged to improve the irrigation and agricultural productivity through effective farmer participation and system managemen, could not achieve their targets due to several reasons. Kerala also followed the same line. The major reasons for the shortfalls of CAD activities in the national level are: (i) inability to achieve adequate, reliable and equitable distribution of water; (ii) failure to ensure participation of farmers in the management of the irrigation systems; (iii) inadequacy of existing organisational set up; (iv) limiting the concept of CADA to a field channel construction programme; and (v) lack of coordination among the Irrigation Department and CADA, and also among various disciplines of CADA. The study conducted at Neyyar Irrigation Project for three years during 1990 – 92 found that though operation plan was made, it was not followed, thereby the very purpose of irrigation is questioned. As a result, a cropping pattern based on the irrigation supply, which is the most important prerequisite for improved productivity could not be adopted in the command areas (Chackacherry, 1993).

Though there have been more than 4000 farmer associations formed in the irrigation commands, most of them are non-functional. Studies have shown that most of these organisations are either defunct or mal-functioning. 25-30% of them are only functional (Chackacherry, 1995; CWRDM, 1999), and they could not play a significant role in the irrigation management processes. However, the main reasons identified for the non-functioning of farmer associations are: (i) the associations were organised on a war-footing through 'government order' ignoring the farmer initiatives; (ii) non-availability of water in their areas at required time; (iii) discontentment of the farmers, as they lost faith in the officials who promised assured water, and also since they failed in making profits; (iv) weak farmer-officer relations; (v) lack of incentives; (vi) political interference; and (vii) insignificant role of the farmer organisations (Chackacherry, 1993). It has been felt that no part of the irrigation system can be handed over to these organisations, if at all they are functioning, as they are not socially capable of taking over the tasks assigned to them (Chackacherry & Madhavachandran, 2006). Either they should be reorganised/restructured or adequately strengthened. On the other hand, the government agency concerned with these activities is neither physically nor socially conducive for taking up a joint management with farmers (CWRDM & CADA, 2001). Therefore, Kerala lags behind many states in the implementation of PIM. Inclusion of a Chapter on PIM in the Kerala Irrigation and Water Conservation Act 2003, and two pilot projects on PIM implemented in two irrigation projects of the State are the only achievements in the history PIM in Kerala.

PILOT PROJECT ON PIM

The pilot projects on PIM which are almost completed in Neyyar (mostly catering garden land crops) and Malampuzha (mostly catering rice) Irrigation Projects, which are almost completed, expect to evolve a strategy for the implementation of PIM in all irrigation projects of Kerala, by demonstrating its possibility and convincing officials, farmers and other stakeholders concerned. The programme envisaged is to transfer O&M of one branch canal each at Neyyar Irrigation Project (Olathanni branch canal – 6.41 km length, 501 ha of ayacut area with garden land crops) and at Malampuzha Irrigation Project (Kuthannur branch canal – 14.63 km length, 1664 ha of ayacut area with rice crop) to farming community. Since the existing farmer organization structure and government set up are not congenial for the implementation of PIM, changes are brought in. Three-tier system with sluice based Water User Associations (WUAs), branch/distributary level WUAs, and project level Project Management Council are the structure tried in the farmer organization set up. Land holder and his/her spouse are members in the sluice WUA, and 1/3rd of the leadership positions at all levels are reserved for women. Overseer, Assistant Engineer/Assistant Executive Engineer, and Executive Engineer, respectively, are attached as competent authorities to these associations to help them in implementing their decisions. Works in the irrigation systems are identified, prioritized and implemented by the WUAs. The payments are made from the bank account jointly managed by President of the Branch WUA and Assistant Engineer of Water Resources Department. The competent authority concerned renders technical advice and ensure that the works are carried out as per technical specifications. Encouraging group farming, bringing women to the mainstream of irrigated agriculture, establishing relations with panchayats, creating opportunities for coordination among the departments/agencies concerned, mobilizing tie-ups with marketing establishments, etc. are other allied activities carried out under the project. The programmes are carried out through five different phases – Preparation, Organisation, Rehabilitation, Capacity Building and Turn-over. Projects at present are in the turn-over phase, where the O&M responsibilities are being transferred to the Branch WUAs.

The experiences of pilot projects so far are encouraging. Impact assessment of PIM from farmers' perspective was done initially using the trade-off model (Naik and Karlo, 2000) in the pilot project area. The results show that farmers have high preference for WUA to manage water allocated to them under PIM. Location of WUA on canals, which influences water availability, was found to be significantly associated with their preferences for WUA. The relative importance assigned by farmers was found to be more for adequate and timely water availability than the agency to manage water under PIM, which indicated the need for adequate maintenance of canals to be handed over to WUAs, and delivery of the required quantity of water at the appropriate time. The farmers attach higher utility to WUA in all the reaches of both the irrigation projects. In all the reaches in Malampuzha project farmers prefer WUA as the agency, even if water supply becomes sometimes adequate and timely. However, in Neyyar project, preference for WUA is seen only when water supply is always adequate and timely. In Neyyar project, farmers in all the reaches have second preference for Panchayath (local self government) as the agency, but only under always adequate and timely water availability condition.

The sluice WUAs have taken over the management of control structures and field channels in both the pilot project areas. The Branch WUAs are in the process of taking over the branch canal systems. Interventions made through the pilot projects have contributed to irrigate an additional area at the rate of 35% and 26% at Neyyar and Malampuzha, respectively. Other positive responses are, better attendance in WUA meetings, promptness in meetings, direct involvement of women in matters related to irrigated agriculture, control over the misuse of canals, improvement in the farmer-officer relations, etc. Another aspect worth mentioning is that the farmers agreed for need based fund allocation for rehabilitation works, though they insisted for equal allocation of the funds initially during prioritization workshops. The allocation ranged from Rs. 0.3 lakh to Rs. 3.0 lakh. The feeling of sense of belonging created through community organisation motivated the WUA leaders to circulate leaflets and pamphlets on the hazards due to the misuse of the canals, and the legal measures taken against that. At Neyyar, where the misuse of the canals is more, the WUA leaders conduct inspections and report to the authorities concerned. In some cases they directly give warning to the violators.

Based on the experiences of the pilot projects on PIM and other studies carried out in Kerala, the contributing and hindering factors specific to Kerala for the implementation of PIM are identified and are discussed below:

CONTRIBUTING FACTORS

BETTER EDUCATION STATUS OF FARMERS

As mentioned earlier, Kerala is the highest in literacy rate than all the states of the country (91%). The State was declared as 100% literate in 1991. In the pilot project areas it was found that less than 2% of the farmers are only illiterates; more than 60% of the farmers have Secondary School Leaving Certificate and above. This capacitates easy communication and understanding, which is one of the major contributing factors for the introduction of PIM.

EXPERIENCE GAINED FROM DECENTRALISATION

Decentralised planning and implementation of development activities is a landmark in the history of Kerala State. The State has established precedence in institutionalising decentralisation and democratisation in development programmes. The experiment on the participatory decentralised planning and implementation started in Kerala during 1997 has obtained tremendous achievement so far. At present, more than 40% of the State Government funds are made available to the local self governments, where the development programmes are planned at the grassroots level. Since PIM enunciates user management at the local level, the existing climate of democratic decentralization could also stimulate PIM.

EXPERIENCES OF CAD AND IMT IN MINOR IRRIGATION

Though the State does not have a long tradition of farmer management, command area development programmes started during 1980s, and community irrigation projects implemented during 1990s, mainly through international funding, have their own contribution in the history of PIM in Kerala. Though CADA could not yield the expected outcome, it provided a platform for change in the outlook of farmers and officials towards a decentralized and democratic system of irrigation management (Chackacherry & Madhavachandran, 2006). Efforts to catalyze farmers will definitely stimulate their initiatives further.

SCOPE FOR WOMEN INVOLVEMENT

Since majority of the men farmers in the command areas of the irrigation projects in Kerala are part-time in agriculture, they have limited interest in irrigated agriculture. Customary gender roles still usually conceive of irrigation management as work for men. But women have great interest in agriculture. Gender Assessment Study conducted earlier by the first author in Kerala has pointed out that when only 25% of men are directly depended on agriculture, as much as 46% of women are involved in it in one way or other (Chackacherry, 1995). In the PIM model tried in the pilot projects, women are members of sluice WUAs as land holders and their spouses are members in them. 40 – 45% of the office bearers of sluice WUAs are women. 1/3rd of the positions in the branch WUAs are women. In most of the training programmes, main participants are women. They show great interest to know about agronomic practices, fertiliser application, water management, etc. In the pilot projects, It has been observed that the men did not have any problem in bringing women to the irrigated agricultural activities. In fact, Kerala women have more influence over their own lives and those of their families than many women elsewhere in the Country. Maybe this is because of better education level of both men and women (Chackacherry & Sudhamony, 1995). All these have great significance, especially when men tend to neglect farming in their small pieces of land.

REPLENISHMENT OF OPEN WELLS BY CANALS

About 79% of the households of Kerala depend on open dug wells (average density of wells is 220 per km^2) for their drinking and domestic water demands, though public piped water supply is there to about 67% of the households (SPB, 2006). Though the State gets high rainfall, as it is spatially and temporally uneven, many of the dug wells dries during summer season (February – May). Discharge through the canals during water distribution often helps to recharge these open wells. Therefore, the people need the canal system, at least for recharging the groundwater source.

HINDERING FACTORS

PART-TIME FARMING

The problem of fragmentation and subdivision of land, contributed by the high population pressures combined with the State Land Reforms Act, is a very serious problem in Kerala (ETS, 1996). As mentioned, the average land holding size is only 0.33 ha, and therefore farming may not be the major income source for many farmers. Majority of the farmers are part-time in cultivation, and therefore, they have to engage in some other vocation for their livelihood. Study conducted among the farmers of an irrigation command in Kerala has found that almost 74 % of farmers in the area are part-time in cultivation (Chackacherry, et al., 1994). Severe decline is observed in the area of rice cultivation. It declined from 7.42 lakh ha in 1952-53 to 6.04 lakh ha in 1987-88. Conversion of rice land (wetland) is occurring in Kerala at an alarming rate (Prakash, 1999). Shortage of labour, and the resulting high labour cost, is another major problem faced by irrigated agriculture in Kerala. More than 55% of the total investment in farming is for labour charge alone (CWRDM & CADA, 2001). All these aspects have led irrigated agriculture to a secondary activity in the State.

LACK OF POLITICAL AND ADMINISTRATIVE ORIENTATION

It is necessary for the political, administrative and irrigation agency leadership to take interest in adopting PIM. It has been reported that though the administrative and technical personnel had satisfactory level of perception regarding participation, attitude towards the same was below the minimal desirable level. Government staff working with command area development programmes, community irrigation projects, and even with the pilot projects on PIM found problems in adapting to the concepts and requirements of the programmes with a clear social dimension. This difficulty to accept social dimensions precludes effective coordination among the staff drawn from different disciplines. There is also considerable reluctance, if not opposition, from the operational staff of irrigation agencies to involving users in management. Reluctance of irrigation officials to organize farmers is yet another concern. In general, Non Governmental Organisations (NGOs) are not accepted either by farmers or officials, mainly because NGOs are not much appreciated in Kerala, and there are very limited successful NGOs in the State. With all their shortcomings, farmers prefer government officials to NGO personnel as 'Catalysts' and 'Facilitators' (CWRDM & CADA, 2001). That is one of the reasons why the Competent Authorities of WUAs have been given a key role in the PIM model evolved for Kerala. Since the local self governments (panchayats) have a strong hold in the local level water resources development, their involvement also is expected to fill the gaps.

MOTIVATIONAL GAPS

There is no incentive structure for the officials to go for PIM. Officials in the pilot project areas tried to ignore the projects and even to delay their implementation. Many officials felt that if the pilot projects are successful, it might lead to retrenchment of positions. Another concern is about funds for rehabilitation works before the systems are handed over to farmers. The impact on agencies depends on whether within their bureaucratic structure they have incentives for solving problems and improving performance, or whether revealing the extent of previous problems only creates difficulties. If agriculture is more profitable, then the farmers will be more interested in irrigation management and scientific agriculture. Increasing incentives and better aligning of PIM with farmers' incentives is essential if participation is to have any hope of being sustained. Without post-turn over support, the goals of turnover will not be achieved and the project effort would largely be wasted. Adequate guidelines, resources and incentives are needed, if guidance and support are to be provided after turnover and the performance of turnover systems sustained.

PAUCITY OF FUNDS FOR SYSTEM REHABILITATION

The paucity of funds and resultant deferred maintenance has caused serious defects in the canal system. The financial outlay for irrigation sector has shown severe decline during the years. When the IXth Five Year Plan (ended during March 2002) outlay for irrigation sector was 6.8% of the total budget of the State, it is only 3.88% during Xth Five Year Plan (ending in March 2007). In Kerala, the water rates are very low compared to the costs of maintenance of major irrigation projects. Though the returns from the irrigation supply have improved over the years, even then it is only about $1/10^{th}$ of the maintenance expenses. During 1999 – 2000 the maintenance cost was Rs. 2177 lakh, where as the receipt was Rs. 70 lakh (3.4%). During 2002 – 2003 the cost was Rs. 1614 lakh and receipt Rs. 102 lakh (6.3%) and during 2003 – 2004, the cost was Rs. 1401 lakh and receipt was Rs. 157 lakh (11.2%). In fact the water rates collected are based on the estimates of 1974. There is no Irrigation service fees concept formulated in Kerala to support O&M. WUAs are not involved in the collection of fees. In the pilot projects also effort was not taken for it as it may create protests and hinder the implementation of the projects. The Revenue Department is expected to collect the water cess, which most of the time is not done systematically. Rehabilitation of the irrigation systems are important because the average rehabilitation cost of existing canals is worked out as Rs.0.1 lakh per ha, whereas the investment required for creating new capacity of irrigation potential is Rs. 1.2 lakh per ha (Anonymous, 2006). For rehabilitation of canals in the pilot projects the amount spent is only Rs. 3040 per ha.

INSUFFICIENT LEGISLATIVE BACKING

While other states have enacted exclusive PIM Acts with all necessary details for the implementation of PIM, Kerala has only a chapter on PIM included in the Kerala Irrigation and Water Conservation Act 2003. Many of the provisions required for the implementation of PIM are yet to be included in the Act. It appears that the PIM Acts of other states, guidelines issued by the National Government on PIM, CAD Act of the State, etc. were not referred when the Act is prepared. The model evolved by CWRDM and CADA for the implementation of PIM in the State, after a one-year long study, was also ignored. This, in effect, reflects the lack of interest and/or reluctance of some corners to accept the concepts of empowerment of farmers and PIM. There is only one tier organization mentioned in the Act, namely, WUAs at the sluice level. Transfer of the irrigation system, agreement between Government and WUAs, etc. are not mentioned. The Act 2003 does not speak about the involvement of women, handing over of O&M, etc (Chackacherry & Madhavachandran, 2006). Therefore, PIM can not be implemented in the State effectively without improvements/changes in the Act, or bringing out a separate Act for PIM.

CONCLUSION

There are several problems that may hinder the implementation of PIM in Kerala, as mentioned above. But prospects are not too bad, as there are several contributing factors. If the irrigation agency supports and nourishes, PIM will nourish in Kerala also. Almost at all levels, it is accepted that there needs a change. But their apprehensions regarding job security and loss of mandate compel them to opt for maintaining the status quo or keep away from the efforts to initiate change. It is expected that the lessons learnt from the pilot projects on PIM may help to gear up the political and administrative will to counter this.

ACKNOWLDEGMENT

The authors gratefully acknowledge the encouragement given to by Dr E J James, Executive Director and Ms V Padmini, Scientist, CWRDM, Kerala, India in conducting the studies and preparing this paper.

REFERENCES

1. Anonymous, 2006. Note on Command Area Development and Water Management, India.
2. CADA. 1996. An Evaluation Report on the Impact of CADA Programme on Production and Productivity of Important Crops in the Commands of the Ten Irrigation Projects under CADA in Kerala State, Command Area Development Authority, Kerala, India.
3. CADA. 2006. Annual Report 2005 – 2006, Command Area Development Authority, Thrissur, Kerala, India.
4. Census Report, 2001. Government of India.
5. Chackacherry, George. 1993. Farmer Participation in Irrigation Management, PhD Thesis, Mahatma Gandhi University, Kerala, India.
6. Chackacherry, George. 1995. Trends in Decentralisation in Water Management in Kerala, Proceedings of the International Conference on Water Management, Tamil Nadu, India, Confederation of Indian Industry.
7. Chackacherry, George; M Nazimuddin; K M Varadan. 1994. Impact of Command Area Development Authority: A Case Study from Kerala, Proceedings of the Southern Regional Workshop on Integrated Development of Irrigated Agriculture, Tamil Nadu, Kerala, India.
8. Chackacherry, George; and K L Sudhamony. 1995. Involvement of Women in Agriculture: Experiences from Kerala State, India, International Conference on Agrarian Questions, The Netherlands.

9. Chackacherry, George; and K Madhavachandran. 2006. Improving Irrigation Efficiency in Kerala through Participatory Irrigation Management: An Analysis, International Journal of Environment and Development, Vol.3, No.1, p55-63.
10. CWRDM. 1999. Evaluation of Beneficiary Farmer Farmers' Associations under Command Area Development Programmes in Kerala, Final Report submitted to Indian National Council for Irrigation and Drainage, New Delhi, India.
11. CWRDM and CADA. 2001. Implementation of Participatory Irrigation Management in Kerala, Centre for Water Resources Development and Management, Kerala, India.
12. ETS. 1996. The Policy Review of the Land and Water Sector in Kerala, Report, Ecotech Services, New Delhi, India.
13. GoK. 1986. The Kerala Command Area Development Act, Government of Kerala, India.
14. GoK. 1990. National Water Management: Detailed Project Report on Neyyar Scheme, Department of Irrigation, Government of Kerala, India.
15. GoK, 2004. Kerala Irrigation and Water Conservation Act, 2003, Government of Kerala, India.
16. Gopal, Naik; and Kalro, A H. 2000. A Methodology for Assessing Impact of Irrigation Management from Farmers' Perspective. Water Policy 2, 445-460
17. Madhavachandran, K; and George Chackacherry. 2004. Factors influencing farmer participation in irrigation management. Journal of Tropical Agriculture, 42 (1-2), 77-79.
18. Prakash, B A (ed.). 1999. Kerala's Economic Development: Issues and Problems, Sage Publications, New Delhi, India.
19. SPB, 2006. Economic Review 2005, State Planning Board, Kerala, India.
20. Thomas, P M. 1999. Agriculture Performance in Kerala, in Prakash, B A (ed.). Kerala's Economic Development: Issues and Problems, Sage Publications, New Delhi, India.

The 4th Asian Regional Conference & 10th International Seminar on
Participatory Irrigation Management
Tehran-Iran May 2-5, 2007

EVALUATION OF PERFORMED NEW IRRIGATION PROJECTS IN THIRD DEVELOPMENT PROGRAM IN ZANJAN PROVINCE AND INTRODUCING THREE SUCCESSFUL SAMPLES

Gholamreza Dawarpanah[1]

ABSTRACT

Increasing water efficiency in agriculture part is the most important solution to reduce law water bad effects and it is crises and will be in future too, because by improving new water sources in all success degrees, wouldn't meet that part's different needs because of wasting 70 percent of using water in agriculture.

So firstly it's necessary to focus our best tries on programming and performing irrigation designs and projects. Regarding to the obtained information from evaluation in irrigation new projects in five years third program in zanjan province performed by organization in contribution with investors, the results of effect amount have been ranked in four levels including excellent, good, moderate and weak, that the projects in zanjan have been evaluated in quantity weak, in quality good, and from these projects, three successful contribution projects have been elected and we introduce them in this article.

INTRODUCTION

Today's, evaluation debate is one of basis in designs and projects which seems that they are measurement and efficiency tools in designs and programs, regarding to aims noted in that design performed and the degree of projects conformity with aims has been shown by observation in performing place and the way of doing and we can obtain result for providing amending acts by strength and weakness points for changing weakness to strength point in points for changing weakness to strength point in future projects, and will be performed as pattern for other designs in future. (1,6) since about 93 percent water from provided water is used in agriculture part and in this part we use only 30 to 35 percent of water efficiency and about 65 to 70 percent water has been wasted (global output in using water is 40 percent), so using new irrigation approaches or improving traditional ways, wasting is reduced and its additional water is used in another parts so that if our country's mean efficiency will be increased about 1 percent, about 0.9 milliard mm3 is saved. So any little change in irrigation efficiency increasing

1- Scientific member of Agricultural and Natural Resources Research Center of Zanjan Province. Zanjan km. 28 Transit Road, P.O.45195/474,
Tel: 0098-242585-3361 Fax: 0098-242585-3351

effect very deep on reducing water crises. Any way, evaluation topic and following it in new irrigation designs is very important.(5, 3)

MATERIALS AND METHODS

Used materials and methods in this evaluation include; using exsiting sources in library archives and studying reports and experiences in quantity and quality evaluation from performed new irrigation projects during third deve lopment program in zanjan province, by con for mity in projects with defined aims, visiting and using expert experiences, interview with experts and investors, finally it was gathering data and obtain the result and offer the suggestions.

STUDY AREA

Zanjan province with area about 22164 km3 in north west of Iran plateau is placed on geographical coordinates between 8, 47 to 35 and 48 east length and 37 and 35 to7 and 36 north width, and in north is restricted to Ardebil east Azarbaijan and in south with Hamedan and Kordestan is confined.

COLLECTING INFORMATION

For evaluating new irrigation project, first in collecting information by referring organizations such as region water organization and water and soil management in agriculture and program, all of activities have been recognized by these institutions and it was defined that in spite of this fact that many innovational projects in order to increase irrigation efficiency such as making irrigation canals and drainage and irrigation net in Mazid Abad and Nor Abad, underground wall projects (cut off-wall) in Kahrizbeik, transfer project of Kazabar water, Mahneshan pumping, water canals in Dehbahar village, soil dam in Yengije, Vanisar pumping Chavarzagh pumping by water organization, but because the aim of evaluation projects in pressured irrigation during third program in zanjan and these projects have been done only by water and soil management in agriculture organization, so in two next steps, defining valuation standards will be noted.

DEFINE INDICATORS AND EVALUATION

In evaluation step, three basic topics were noted:

1- Quantity evaluation; In this evaluation, The province share amount defined for third years program with performed amount has been compared in this province.
2- 2.Quality evaluation; In this evaluation, comparing static safe projects using unstable destructive or repair projects and feature were noted which include technical features, innovations and results design compared with designed basic aim and little or basic technical deficiencies.
3- Contribution evaluation;

In this evaluation, the degree of exploiters contribution in design, contribution in performance, financial contribution and exploit contribution have been noted.

CONCLUSION AND DISCUSSION

Regarding to evaluation approach, the results obtained have been offered as this table.

Table of quantity evaluation in new pressured irrigation projects during third program in zanjan province

Number	design kind	defined share in organization during third program (ha)	performed level degree	success relative to organization developed (percent)	deduction from organization develop indicator (percent)	Result of evaluation	Respected degree according to the develop indicator	Deduct From Respected indicator	Result Of Province Indicator
1	study	12500 ha	7750 ha	% 62	% -38	good	-	-	-
2	perform	7500 ha	2573	% 34.3	% -65.7	weak	10624	76	weak
sum	-	20000 ha	10323	% 51.6	% -48.4	moderate	-	-	-

Based on third development program in agriculture part, it was seemed that water products under culture land totally 28600 would increase that it needed 307 million mm3, which in 192.8 mm3 from ground water and 114.9 mm3 from underground water will be provided.

If only 2 percent of this number and 10 percent of the under culture lands are irrigated through new irrigated (pressured), expected lands to pressured irrigation would be 10624 that regarding to performed lands amounts 2573 that it's 24 percent of expected lands, so effect of irrigation in saving water usage and increasing performance from quantity point is weak and contribution and evaluation of quality has been good. As a general suggestion, we can note that in order to motivate in investors, it's necessary to use encourage policies for using new irrigation approaches comparing to those who don't use them. For example we calculate water and power costs in different ways for two parts.

It must be noted that agriculture share from the underground water sources (by deep and semi deep wells) that is 324 million mm3 (85 percent of all wells), is from nation mean for retardation compensation.

Table of perfumed new irrigation (pressure) project's quality evaluation during third program in zanjan province.

number	description	evaluation		evaluation result			
		positive	negative	excellent	good	moderate	weak
1	defined aim in performed project	*			*		
2	useful life in performed project	*			*		
3	defined function in project	*				*	
4	perforce of technical and engineering parameters	*			*		

Table of contribution degree of exploiters in performed new irrigation (pressured) project during third program in zanjan province.

number	description	Evaluation		Evaluation result			
		positive	negative	excellent	good	moderate	weak
1	contribution in design	*				*	
2	contribution in execution	*				*	
3	financial Contribution	*		*			
4	Contribution in exploiting	*		*			

GENERAL CONCLUSION

Since the aim of reconstruction project execution in time section aims in development program and effect degree for exploiters, so when these project can be base of a region development that in addition to meeting quantity and quality for people acceptance, contribution will result in better keeping and stable, would be made.

Regarding to performed evaluations from pressured irrigation in third program in zanjan, it was realized that these projects aren't conformities in contribution degree from quality point.

SUGGESTIONS AND ADVICES

1- Improve and equip statistic networks from nation water sources must be provided accurately from quantity and quality point to continuous evaluation in times.

2- Measurement networks install and improve of water usage in agriculture part.

3- Increasing irrigation efficiency and exploiting water and increasing under culture lands as successful level in efficiency.

4- Performing the artificial feeding projects in province lands by ground water's specially in non culture seasons.

5- Help to farmers unities for correct exploitation from water sources and increasing irrigation efficiency and attract investors contributions in water designs investments.

6- 6.Regarding to obtained result from studies about comparing evaluation of pressured irrigation ways and groove way and difference in irrigation efficiency (at least 20 percent) it's necessary in pressure way to use more lands from irrigated farms.

REFERENCES

1. Evaluation of water projects in sirjan area, Ghaem Maghamian, Shahram shahvavi, mehdi, first global water conference, water and soil management ordibehesht 1383, Bahonar university of Kerman, P. 14.
2. Evaluation soil dams in Golestan, Saneii, Mojtaba Ghoraishi zade, Seid Hamid Reza, science journal in soil and water management, first year, no.1 spring1384, p21.
3. Technical comparing the rain and groove irrigation. Sohrabi, teimor, Asli manesh, reza, second nation conference articles, water and soil, Tehran, bahman 1375, p. 131.
4. 4.water food safety source, Asadi, Mohamad Esmail, global conference and soil and water management, ordibehesht 1383, Bahonar University, p.73.
5. Water use function and beet root crop performance in two leakage and tip irrigation system, Ghasemi firoazabadi, Mirzaii Ali, Mohammad Reza, national water conference and soil and water management, ordibehesht 1383, Bahonar university, p.77.
6. Using rain irrigation in sand soils, Riahi, Hamid, national water conference and soil and water management, ordibehesht 1383, Bahonar University, p.83.

MEASURING SUSTAINABILITY: MONITORING & EVALUATION OF THE PERFORMANCE OF WATER USER ASSOCIATIONS

Ele Jan Saaf[1]

ABSTRACT

Participatory Irrigation Management (PIM) has been introduced in a large number of countries worldwide. In many cases much attention was given to establishing or developing water user associations (WUAs). Many resources have been spent on analyzing and standardizing an approach to introducing PIM. However few resources have been allocated to developing indicators for monitoring and evaluation (M&E) of the performance of WUAs. The sustainability of WUAs within the specific socio-cultural context of the countries in which they have been introduced/developed requires more consideration.

This paper consists of three consecutive themes. These themes are, (i) international experience with measuring performance of WUAs, based upon the experience of the author and other relevant case studies, (ii) common pitfalls for sustainability of WUAs, and (iii) main technical and institutional indicators for measuring WUA performance.

The paper presents concrete and practical indicators for measuring WUA performance, and links these to the sustainability of WUAs and PIM. The objective of the paper and the presentation is to share these indicators and to generate discussion on the feasibility of the indicators in light of the specific socio-cultural circumstances in different countries.

The paper finally presents institutional arrangements for M&E of WUA performance, such as Federations of WUAs, the role of national, regional and local authorities in measuring WUA performance and the maturing of PIM as a process of development. This paper puts forward a hands-on approach for policy makers, implementation experts, academics and consultants for ensuring and improving the sustainability of PIM.

1- Mr. Saaf is General Director of Saafconsult B.V. (Dillenburgerstraat 9a, 5652 AM Eindhoven, The Netherlands, fax: +92 51 2101167, @: info@saafconsult.com, tel: +92 51 2101151, url:www.saafconsult.com), senior consultant for water management and a member of the Commission for Ecosystem Management of the World Conservation Union (IUCN).

INTRODUCTION

Participatory Irrigation Management (PIM) has been introduced in a large number of countries worldwide, with mixed success. PIM was developed by the World Bank as a workable concept to introduce community based participatory management of irrigation infrastructure. However, community based development and management of irrigation infrastructure has been practiced in many countries of the Middle East and South Asia region for centuries. One beautiful example is the construction of Khettara's[1] in Morocco, Syria & Pakistan (Balochistan), which were built and maintained by communities centuries ago. Families actually attained water rights on the basis of the comparative effort or resources they invested in the construction and maintenance.

Whereas much time and effort has been invested by a large number of donors and development organizations in the establishment of Water User Associations (WUAs) as a manifestation of PIM, less time and effort was attributed to the post-intervention period, during which continued institutional and technical assistance to WUAs is required. Furthermore, WUAs are placed within an institutional framework that is usually dominated by the public sector. Whereas WUAs are non-governmental organizations (NGOs) they are given an important chunk of tasks and responsibilities that were initially owned by the public sector. It is therefore important that the performance of WUAs is monitored periodically. However, monitoring of performance of NGOs by the public sector can lead to serious complications due to different frames of reference and modes of operation.

This paper presents three themes: (i) international experience with measuring performance of WUAs, based upon the experience of the author and other relevant case studies, (ii) common pitfalls for sustainability of WUAs, and (iii) main technical and institutional indicators for measuring WUA performance. The paper attempts to make a case for increased attention to the post-intervention phase of introductory processes of PIM and for fair and effective monitoring and evaluation of the performance of WUAs.

INTERNATIONAL EXPERIENCE WITH M&E OF WUAs

Performance and sustainability of WUAs can be measured on the basis of two key determinants; (i) legitimacy, and (ii) relevance. Legitimacy is defined as, "organisations that are recognised by all third parties with which they interact and are considered the legitimate organisation for its' defined purpose."[i] Relevance is defined as, "organisations are accepted by their beneficiaries as the organisations representing their interests and address issues that are recognised and considered relevant for and by the beneficiaries (are addressing "actually felt needs")"[ii]. Through monitoring of these two key determinants, many other determinants and parameters can be extrapolated. Some of these are autonomy, legality and accountability.

In Egypt, the Netherlands Development Cooperation has been funding a series of projects aimed at developing and institutionalizing concepts of PIM. The Waterboards Project has developed a complex system of monitoring and evaluation (M&E) of

---

1- A system of vertical wells in the alluvial fans at the foot of the mountains interconnected by a horizontal underground tunnel that intercepts the water table near the head of the alluvium, and provides a dependable source of water flowing under gravity to valley alluviums where agriculture is mostly practiced. They are also known as Karez or Qana'at in Balochistan and the Middle East.

Waterboards on the basis of the two key determinants described above. They are currently in the process of field-testing the M&E system. Problems have arisen regarding calibration, as those WUAs established by the project score better than those established by government or other projects.

The International Fund for Agricultural Development (IFAD) has financed a four year programme called, "Action Research Programme on the Identification and Testing of Methodologies and Approaches for Effective Introduction of Participatory Irrigation Management". This programme was implemented by the International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM) in Bari, Italy. The main objective of the programme was to help member countries (of IFAD) to take advantage of proven lessons emanating from international experience with PIM to contribute to sustainable rural development. The four countries in which the programme was implemented were Morocco, Tunisia, Egypt and Armenia. In Armenia, special attention was given to the development of indicators for monitoring of performance of WUAs.

The main constraint identified when measuring the performance of WUAs in Armenia was that there was a gap in terms of understanding, expectations and feasibility of the tasks and responsibilities. This gap existed between the monitoring party, i.e. government, and the object of monitoring, the WUAs. Whereas the WUAs were established by law within a very short period of time, government divested itself of its tasks to maintain irrigation infrastructure and simultaneously imposed Value Added tax on water sales. The WUAs did not have the experience and capacity to generate sufficient revenue to initiate the necessary O&M, as a result of which the whole process came to a standstill, especially in the poorer upland regions of the country. Performance indicators measured unacceptably dismal performances, as a result of which the process of introducing PIM was questioned. This example illustrates quite nicely how a government apparatus can be convinced by external donors and consultants to expect unrealistic benefits of introducing PIM, as a result thereof develops ambitious plans and finds that after the projects introducing PIM are finished that things are not as expected. Often the result is that governments subvert WUAs by minimising their legal status and their options for revenue generation. As a result these WUAs lose their legitimacy and relevance and become unsustainable.

M&E of WUAs has to take place within a context of mutual understanding and cooperation between the monitor and the object of monitoring. This in turn pleads the case for continued institutional support for WUAs after establishment. This institutional support has to be embedded within the national structures to ensure that the support provider grows along with the WUAs. This will ensure that support will always be geared to the needs of the WUAs.

COMMON PITFALLS FOR SUSTAINABILITY OF WUAs

To enable WUAs to be and remain sustainable, legitimacy and relevance are crucial. Since WUAs are usually membership organisations, their interventions must be credible and seen to provide a beneficial service to (a large number of) members. Government policies for maintenance of irrigation infrastructure are often of the "Build – Neglect – Rebuild" kind. This has caused most users of the irrigation infrastructure to lose faith in government policies and interventions.

For WUAs to become accepted as the legitimate and relevant organisation within the community to take charge of O&M of the irrigation infrastructure, which is so crucial to their daily survival, they must be able to provide better and more timely services than government did. This means that they must be able to generate sufficient revenue to sustain these services. To generate this revenue they must be paid for the service that they provide. Instilling a sense of payment for service in rural communities is often difficult, as water is seen as a free commodity and often as a gift from God. A second crucial element of sustainable WUAs to enable them to attain and maintain their legitimacy and relevance is a conflict resolution mechanism. A common pitfall during the establishment of WUAs is to limit their revenue generation capacity and their legal status, whereby the attainment of legitimacy and relevance is much more difficult.

On the other hand, if during establishment of the WUAs the focus is too much on legal and financial issues, other crucial elements of the functioning of WUAs can be neglected, such as social mobilisation and conflict resolution.[1]

Another common pitfall for the introduction of PIM is the, "Rehabilitation – Dependency – Deterioration Trap".[iii] This trap is sprung when selected WUAs are given financial support by external parties such as donors. Infrastructure is rehabilitated and the operational basis the WUA is optimised. As a result water provision to beneficiaries is improved and a process of payment for service is either initiated or re-instituted. However, peripheral WUAs that were not selected for additional financing still have to struggle along the traditional ways. As a result government often steps in to help them solve their immediate problems and a dependency on government continues. Very often beneficiaries of these systems are disgruntled and pay little or nothing to the WUA. A situation of perceived inequity arises, whereby the beneficiaries of the operational systems ask why they have to pay so much for a service that the government is providing (more or less) free of charge for neighbouring WUAs. As a result they start reducing payments and the rehabilitated infrastructure deteriorates and the situation is back to square one after a few years. This trap again shows how important it is to continue support to WUAs, including awareness and continued assistance.

MAIN TECHNICAL AND INSTITUTIONAL INDICATORS FOR MEASURING WUA PERFORMANCE

The measuring of performance of WUAs can be sub-divided into three areas: (i) efficiency of services, (ii) institutional and financial sustainability, and (iii) impact of services. The first area measures whether the WUA is "doing things right". The second area measures whether the WUA is institutionally and financially sustainable. The third set of indicators measures whether the WUA is "doing the rights things".

For the development of indicators on efficiency of services a performance variable has to be compared to the "cost" of the performance. For efficiency the question, "are we doing things right" in terms of cost (financial, organisational, societal, etc.) is relevant. The indicators are therefore by nature often compound indicators that associate a

1- A case in point is Egypt, where WUAs at present do not have a legal status that allows them to generate revenues, but nonetheless they are active in conflict resolution and water use optimization activities.

number of phenomena. Two of the most common indicators for efficiency of services are:

1. The actual cost per m3 of irrigation water provided;
2. Labour costs of the WUA vs. irrigated area.

For indicators that measure institutional and financial sustainability, reference is made to the two key determinants of legitimacy and relevance mentioned above. Two indicators that can measure institutional and financial sustainability are:

1. An increase in farmers that refer to the WUAs as the relevant organisation for water management in their area;
2. Increased cash flow (payments for water and/or membership fees) to the WUAs.

Finally, indicators that measure performance of WUAs in terms of impact of services have to be compared to targets to analyse changes over time. Two indicators for impact of services of WUAs are:

1. Changes in the ratio of irrigated vs. irrigable area;
2. Changes in water use (m3/crop/ha).

A final note on the validity and relevance of the indicators is essential. It must be kept in mind that the performance of WUAs is affected by a large number of variables. More indicators are needed as “checks and balances” and triangulation indicators to ensure validity and relevance. Furthermore the performance of WUAs should always be seen in the socio-economic context in which they operate.

INSTITUTIONAL ARRANGEMENTS FOR M&E OF WUA PERFORMANCE.

As already indicated in earlier sections, the post-intervention phase following the introduction of PIM is crucial for sustainability of WUAs and PIM. Whereas PIM can be a very effective tool for divestment of task and responsibilities, if not followed-up properly it can fail dismally.

In many developing countries there is a general apprehension of privatization and commoditization of natural resource management services. This is especially true for water provision. Once the introductory process of PIM has overcome the initial hurdles and apprehensions of civil society it has to prove its case. The risk is that if the introduction fails, adversaries of PIM will be able to prove their case, as can be seen in Pakistan, where initial introduction was difficult and both donors and the government more or less abandoned WUAs and Farmer Organisations after the initial introduction. At present it is likely that the complete process of Irrigation Management Transfer will be abandoned as a failure and the management of irrigation will revert back to the centralized provincial system.

To continue providing support to WUAs there are several options that can be followed:

1. Establishment of a “Federation of WUAs” that would pursue the interests of WUAs and would be a direct “window” for government to address WUAs. Such a Federation would also provide continued capacity building support and relevant training.

2. A cell within the relevant regional or national governments that has as its main task the support and capacity building of WUAs, without being a top-down control mechanism;
3. Private sector M&E of WUA performance linked to a multi-stakeholder platform consisting of civil society and government organizations that periodically review WUA performance and advise the government on capacity building and support activities for WUAs.

To conclude, M&E of WUAs is crucial for their legitimacy and to provide information on performance. However, M&E has to take place within a context of joint efforts and interests to improve irrigation and water management to alleviate poverty in rural areas, and not as an objective as such.

i- Royal Haskoning, 2002, Waterboards Project.
ii- Royal Haskoning, 2002, Waterboards Project
iii- Vermillion & Sagardoy, 1999, Transfer of Irrigation Management Services, FAO, Irrigation and Drainage Paper 58: 28.

TACTICS FOR CREATING PARTICIPATORY MANEGEMENT IN IRRIGATION NETWORKS AND STUDING THE FACTORS EFFECTIVE ON ITS STABILITY

Mohammad Ali Rahimi Jamnani[1], Ehteram Ghelichzadeh[2], Hossein Taghipour[2], Hossein Abouali[3]

ABSTRACT

Participatory management in irrigation is among the issues which were provoked for discussion in recent decade for exploiting the irrigation and drainage networks of different countries irrespective of their involving infrastructural facilities.

Considering the competition in consumption of agricultural water and optimum use of accessible water resources, generally the governmental management faces serious challenges in meeting the needs of users. On the other hand, the private sector looks at it doubtfully because of high risk in investment on agricultural water.

In this study the manner of creating participative irrigation management in Foumanat Irrigation Network (Gilan Province) and Soufichai Irrigation Network (East Azerbaijan Province) has been studied and discussed.

Foumanat Irrigation Network is a network with an age of more than 30 years and covers an area approximately 50,000 hectares. The main crop of the area is rice. Soufichai Irrigation Network is about 8 years old and covers an area about 12,000 hectares. The main crop of the area are cereals and fruits.

Key Words: Participatory Management, Agricultural Water, Risk Taking, Governmental Management, Foumanat, Soufichai

1. INTRODUCTION

Participation is one very important issue in developing countries. Participation of the people in administering the villages and their participation in decision making in macro level especially in long-term policies, demand the achievement of the aims and stability of the achievements. In our country, in past two decades participation in its general

1- Expert in Tehran Water-Soil Consultant Engineers Company E-Mail: rahimi_mali@yahoo.com
Tel.: +98 261 2500208-11 Fax: +98 261 2505600
2- Expert in Tehran Water-Soil Consultant Engineers Company
3- Expert in Regional Water Organization of East Azerbayejan Province

sense was somehow pale in all socio-economic fields. At post-war period when the development projects started, the lack of participation culture in people was considered a vacuum. Gradually the culture grew among the people to some degree. Perhaps the expansion of apartment dwelling is one of the aspects of promulgation of participation culture in urban communities. Of course, still the place of a cohesive organization for promotion of participation level of people in urban problems is felt. Different ministries and organizations call more participation of people in their projects and aims.

In rural areas, because of poverty and strong agricultural culture and other reasons, participation culture has developed in lesser degree than urban areas. However, recent years witness some common activities in villages. Election for Village Council Members is an example.

Considering the above facts, if the administration manner of villages and its restrictions be not deeply studied and reconstructed, participating in one constituent of rural life such as irrigation actually faces problems. In a word, promotion of participation shall be a process coming down from the top and without making the needed infrastructures it will be fruitless and instable to expect participation. The relevant infrastructures, for instance legal issues and necessary laws for respecting the participation council, shall be institutionalized so strongly that all individuals and organizations have no choice but comply with that culture and respect it.

This research has studied and appraised the participation in irrigational affairs of Foumanat and Soufichai Irrigation Networks in a 10-12-year period and compared these two with each other.

2. FOUMANAT IRRIGATION NETWORK

Foumanat Irrigation Network consists of irrigation networks of Soumesara, Fouman, Shaft, and Toulam Shahr areas with surface area of about 50,000 hectares in north of the Iran. The main crop is rice, that is, about 90% of the area is used for rice growing. In primary plan, the needed water was estimated to be 32 m^3/s and it was provided from Tarik Dam at downstream of Sefidroud Dam through a water tunnel that is stretched to Foumanat. Increased cultivated area in recent years was so high that produced difficulties, the difficulties which will be explained later. Figure 1 shows the layout of Foumanat Irrigation Network. In this network, water distribution is controlled and regulated by six Irrigation Bureaus.

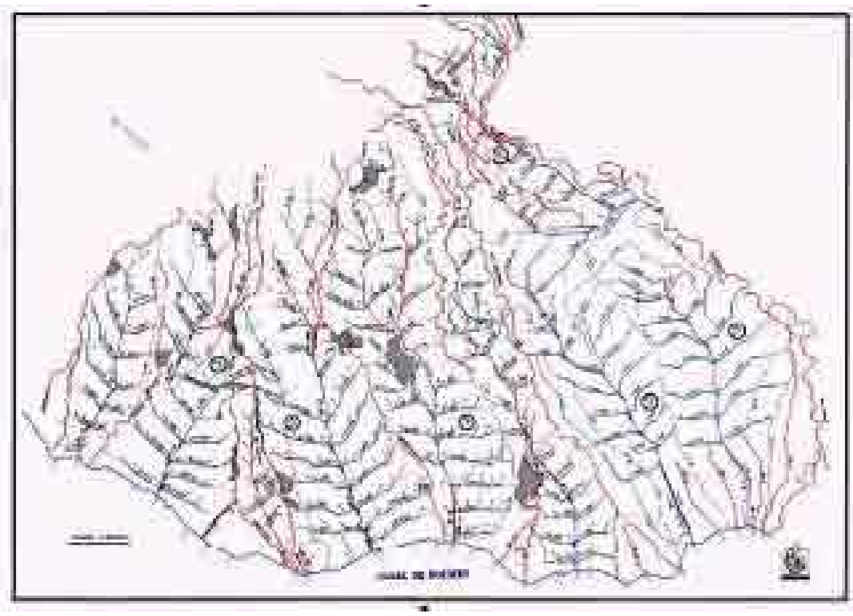


Figure 1. Layout of Foumanat Irrigation Network

2-1- PARTICIPATION IN FOUMANAT IRRIGATION NETWORK

Studying the participation process of the users of Foumanat Irrigation Network in present situation and studying the manner of assigning water distribution management of this network were among the aims of this research made in years 1994 to 1996.

The opinions of the users have been obtained by local interview and filling the questionnaires. Photograph 1 is a scene of local interview in the area.

Photograph 1. A Scene of Local Interview in the Area Covered by the Research

2-2- PRESENT SITUATION OF PARTICIPATION

At present (at the time the studies were being made), water for agricultural purposes is distributed by "water distributors" and "assistant water distributors" elected by the farmers. However, there is no special organization for this election. A person who intends to be "water distributor" or "assistant water distributor" collects the signatures of the farmers and submits the signed nomination form to Irrigation Bureau and

Irrigation Bureau confirms his position. The remuneration of "assistant distributors" is paid by the farmers in proportion to the water they receive and manner of water receipt. This arrangement has been common since very old time and even it may go back to pre-land reform era.

As seen above, the farmers are familiar with their role in irrigation participation but there are some marginal problems related to the degree of participation which are connected to physical system and management of Foumanat Irrigation Network.

2-3- STUDYING THE FUNCTION OF IRRIGATION NETWORK IN PARTICIPATION PROCESS

Foumanat Irrigation Network is about 35 years old. During this period of exploitation, some faults that have been observed by the users have been occurred. The most important faults are as follows:

A). Non-completion of the irrigation and drainage network so that not all lands are covered.

B). Increase in cultivated lands especially after Revolution because of dividing land of the forest area and bodies water which were effective in misbalancing of water consumption in irrigation network.

C). Cultivation on the limits of main and secondary canals whose solution is a real problem. Providing water for these plots of land is among the problems facing the network management. What is seen in Photograph 2 is an example of cultivation on canal limits.

D). Non-sufficient maintenance of main and secondary canals of the network (The main canals are concrete and subsidiary canals are semi oval and aerial type). Obstruction in canals because of accumulated sediments and growing plants in the canals have been showed in Photograph 3.

E). Increase in cultivated lands and non-provision of a modern irrigation network for those lands and since supplying water in consumption peak of water is not certain, the farmers have broken the canals and or have created blockages in sections of canal entrance to get water for their lands sooner. Photograph 4 shows this reality.

F). One of the network problem is illegal off take that in present is as right for whom used water in this method.

Photograph 2. Example of Cultivation on Canal Limits

Photograph 3. Obstruction Created by Accumulated Sediments and Growing Plant in the Canals

Photograph 4. Creating Blockage in Canal Sections for Getting Needed Water

2-4- GETTING RESULTS FROM PARTICIPATION STUDIES IN FOUMANAT IRRIGATION NETWORK

The main question was that how the management of second class canals and distribution water up to the fields may be assigned to the farmers.

If the above mentioned points be considered, it is clear that the farmers by no means are ready to accept participation in exploitation and maintenance of the network. Based on the questionnaire filled by the farmers, they look at participation as an acceptable and practicable thing but the situation of the network prevents them from daring to participate. Also, there are some principal questions whose answers must be provided in advance.

1. What is given to the farmers and what is expected from them against such grant.
2. Up to what level the management on second class and water distribution is assigned to the farmers and there is not any legal vacuum for such powers.
3. How the farmers will become certain for solving the water shortage problem. What is most disturbing for the farmers is that the network management shall not be able to guarantee water supply for agriculture.

In years of this study none of above questions has been answered convincingly and it was not clear that which tools should be introduced to the farmers to create the belief that their needed water would be supplied and distributed by a reliable system. We have to note that in years of study (1994-1996) none of participative institutions such as elected city councils and village councils did not exist.

3. SOUFICHAI IRRIGATION NETWORK

The water of Soufichai Irrigation Network is supplied from Alavian Dam. This network locates at extreme part of the southwest of East Azerbaijan Province and covers the lands of Maragheh and Bonab areas. The dam and the network started to be used in 1996. The surface area of the project was estimated to be 12,500 hectares. The dominant agricultural activity of the area is growing vines, fruit trees, and wheat. Figure 2 shows the layout of Soufichai Irrigation and Drainage Network

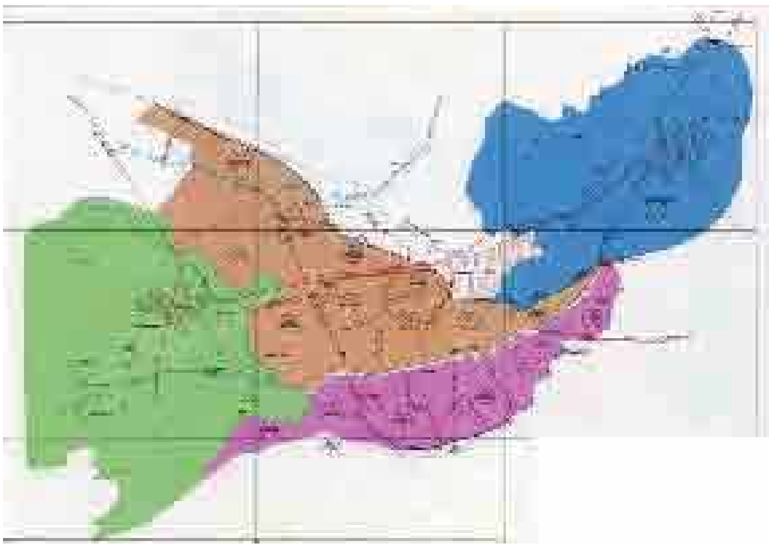


Figure 2. shows the layout of Soufichai Irrigation and Drainage Network.

3-1- PARTICULARS OF SOUFICHAI IRRIGATION NETWORK

As it is seen in Figure 2, this network consists of four different districts. District I which Covers a surface measuring 2500 hectares locates at downstream of the dam and at present is irrigated by traditional irrigation streams. There is no underground water in this district. In Districts II and III whose surface areas are 3,600 and 2,500 hectares, respectively, modern irrigation network has been constructed and water in transferred to the farms through concrete (job-mix concrete) canals. In these two districts underground water is used extensively. Further, water in district III is supplemented by water of Varjouchai River too. In district IV which locates at the end of the network area and covers about 3,900 hectares, the traditional irrigation streams are used for distribution of water. Among restrictions existing in this area, high level of underground water, extreme use of underground water, and flow of salty water through Urmia Lake (existing adjacent to the area), may be mentioned. Underground water provides about 40-50 percent of the needed water. Further, potable water of Maragheh City is supplied from Alavian Dam.

As it is observed the irrigation particulars are different in four irrigation districts and there are different interactions between the irrigation exploitation management and farmers.

3-2- PARTICIPATION IN SOUFICHAI IRRIGATION NETWORK

When exploitation of the network started in 1996-97, participation was seriously discussed in the country. Though the discussion was running in academic level but gradually different strata of the population were involved and ordinary people were getting familiar with concept of participation. Elections of city councils and village councils and assigning the urban and rural activities to elected persons of same city or village have arisen in all levels of the society the discussion on participation of people in decision makings. In line with these developments, formation of Cooperative Societies of Water Users have been designed by Regional Water Organization of East Azerbaijan and Ardebil Provinces for Soufichai Irrigation and Drainage Network and its implementation is followed up.

3-3- PRESENT SITUATION OF PARTICIPATION

At present some 21 cooperative societies of water users have been formed and are active in the area covered by Soufichai Irrigation Network and 12 other societies are in process of formation. The area covered by each society spans between 72 and 1,770 hectares. The members of each society are 32 to 576 persons and each member has about 2.1-3.4 hectares of land. In irrigation districts II and III, are villages have cooperative society of water users and in districts I and IV, the societies are being formed. Of course, in district No.IV, four villages have already formed their cooperative societies. The process of cooperative societies formation in Soufichai Network started in 1995-96 and is continuing.

3-4- REQUIREMENTS OF PARTICIPATION IN SOUFICHAI IRRIGATION NETWORK

As it was pointed out, in all areas the creation of participation depends on their environment and social structures. Based on this approach, in respect of developing participation in Soufichai Irrigation Network situation is as follows:

1. Being Newly-Founded Network: Since the network is newly-founded the farmers are not mentally ready to assume responsibility of maintenance and exploitation of new canals. The maintenance cost of the canals in beginning years is low and so

the farmers and newly-founded cooperative societies have lesser engagement with each other and with mother exploiting on company.

2. In beginning years of exploitation of the network the social environment was more suitable for accepting participation and creating capacities of participation for involving the farmers in exploitation and maintenance of the irrigation network. Therefore, the two poles of this participation, that is, the main exploiting company (the mother company) was more ready to assign the responsibility and the farmers were more willing to assume the responsibility.
3. Increased number of the degree-holders, especially those graduated in agricultural engineering and irrigation fields, drove them to private sector and many of them are working as managing director of the cooperative societies of water users. Since they are familiar with the local situation of water and agricultural activities they have been effective in enriching the insight of the farmers toward optimum use of water in agricultural sector.
4. Existence of participation approach in Regional Water Organization of East Azerbaijan Province and seeking the opinions and proposals of the water users in implementation of irrigation projects too have played important role in formation of the cooperative societies of water users.

3-5- STUDYING THE PROBLEMS OF FARMERS' PARTICIPATION IN SOUFICHAI IRRIGATION NETWORK

Participation of the users in exploitation and maintenance of irrigation networks is a newly established institution and so naturally the problems and difficulties are less likely to show themselves. The most important problems in continuation of the activities of the cooperative societies of water users in Soufichai Irrigation Network are as follows:

1. Lack of sufficient training and conception in the users about the place of these societies in respect of interaction with mother exploiting company.
2. The fact that the users are not familiar with their roles in the cooperative societies in respect of attending in general meetings, electing the managing director, and …
3. The members are not familiar with the legal role of these societies in civil institutions.
4. The users are not familiar with the interactions between the water users cooperative societies.
5. The users are not sufficiently trained and familiar with system for allocating and distributing agricultural water.
6. The mother exploiting company has not fulfilled its obligations toward water users cooperative societies in delivering the allocated water.

As it is evident in above sections, in Soufichai Irrigation Network the allocation and distribution of agricultural water are among the instances which may originate a lot of problems in the activities of water users cooperative societies. The issue has been under discussion in Regional Water Organization of East Azerbaijan Province since 2-3 years ago and it was tried to find a way for systematizing water allocation and distribution in such a way that the obligations of mother exploiting company toward the water users cooperative societies can be fulfilled with minor changes. The mother exploiting company has also thinking about the possibility of designing a system which makes the cooperative societies certain about their needed water. It is sure that such certainly will facilitate the planning and will minimize the problems and disputes between farmers who are member of water users cooperative societies and these societies.

As it was pointed out earlier same problem was stated by the farmers covered by Foumanat Irrigation Network too. In other words, the necessity of a tool for estimating the needed water and manner of distribution exists in both networks under study. For meeting this necessity, a model has been developed for estimating the needed water and manner of distribution in Soufichai Network. The model is recommended as a pattern for other networks too.

4. MODEL FOR ALLOCATION AND DISTRIBUTION OF WATER IN SOUFICHAI IRRIGATION NETWORK

Based on above discussions and for strengthening the stability of water users cooperative societies, a model has been developed as a tool for allocation and distribution manner of water in Soufichai Irrigation Network. The model estimates the flow of Soiufichai River into Alavian Dam and predicts the allocation and distribution of water in each irrigation area of Soufichai Irrigation Network on monthly base. Figure 3 shows a scheme of the model. Further, Figure 4 shows outflow which is the water allocated to each product at any time in each irrigation area. By applying this model, the mother exploiting company will be able to predict the water needs of coming crop year and determines for each area the maximum surface of land which match with that amount of water. At present, this model has been used in Soufichai Irrigation Network and as a primary appraisal aiming to improve the predictions of the model in estimating the flow of Soufichai River, the results of the model are in process of calibration. The model may not be operational unless with getting the directors of water users cooperative societies familiar with the model and showing them the process of the calculations related to water allocation and distribution.

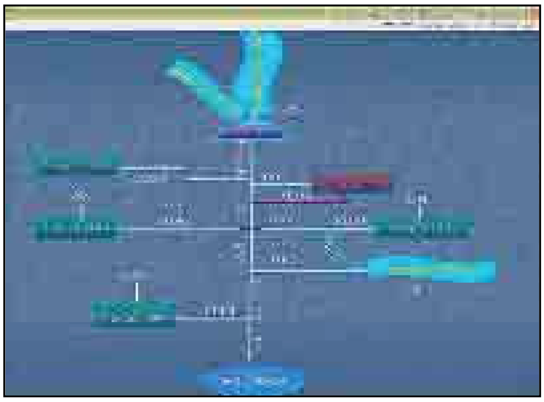


Figure 3. Scheme of the Main Page of the Water Allocation Model of Soufichai Irrigation Network

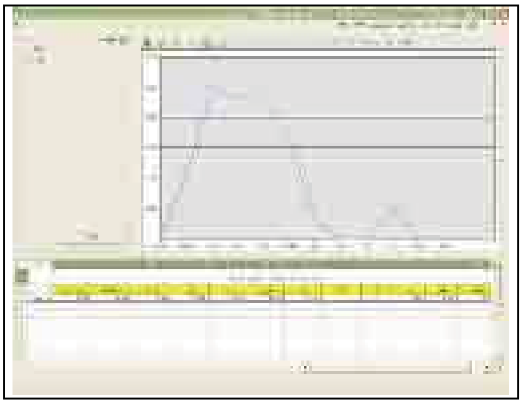


Figure 4. Scheme of the Output of the Water Allocation & Distribution Model of Soufichai Irrigation Network

4-1- ADVANTAGES OF EXPLOITATION MODEL:

1. Simplicity of the model for being applied.
2. Accessibility of the process of the calculations related to allocation and distribution in the network through observing the outputs of the model in each calculation step.
3. Creating common look in mother exploiting company and water users cooperative societies as far as the prediction of water resources in coming water year is concerned.
4. Becoming aware of the amount of surface and underground water sources accessible in each irrigation area and thus, for each water users cooperative society.
5. Preventing non-expert interventions of persons not being responsible in distribution of network water.
6. Paving the way for participation of the water users cooperative societies for overcoming the probable water crisis in coming crop year based on identification of new water sources in the network.
7. Optimum use of agricultural water in the irrigation network

5. CONCLUSIONS

Participation in exploitation and maintenance of irrigation networks is not independent from ways of participation in rural and urban societies. The ways and degree of participation in irrigation networks depend on two poles or two arms. The first arm is the degree of willingness of the mother exploiting company to assigning part of its responsibilities and the second arm is the users who are going to accept the responsibility. For explanation of common issues especially the ways of allocation and distribution of water in irrigation networks, both these poles need a tool. In irrigation networks, applying a model which is able to demonstrate water allocation to each product at any time in each irrigation area is among the means that would calm the tension between the users especially in low-water years and this, in turn would lead to more activity and stability of water users cooperative societies.

6- SOURCES

1. Tehran Water-Soil Consultant Engineers Company, 2005, <u>Socio-Economic Assessment of Water Allocation Policy in Soufichai Irrigation and Drainage Network, Part 1, Basic Studies,</u>.
2. Tehran Water-Soil Consultant Engineers Company, 2004, <u>Developing the Dynamic Model of Applied Exploitation of Alavian Dam and Optimum Allocation of Water to Downstream Consumption</u>.

FORMULATION PROCESS OF COMMUNITY DEVELOPMENT PLAN IN SEMI-ARID AREA

Michimasa Menjo[1], Tomoki Hotta[2], Takahiro Kato[3]

ABSTRACT

This paper presents agricultural and rural development policy of the Government of Morocco in the arid region located at the southeast of the Atlas Mountains. The Japan International Cooperation Agency (JICA) has completed the Master plan study for irrigation and community development plan in the Tafilalet region, and the author, study team presents lessons of policy-makers how they have been coordinating rural development schemes in the region.

The region severely lacks rainfall, with only 50 to 200 mm per annum and agricultural activities are fully dependent on torrential water and groundwater through subsurface tunnel structures, which are called "the khettara" in Morocco. A recent inventory study indicates that the productive khettara has reduced to about 190 khettaras compared to about 570 khettaras in 1970s because of decrease of water discharge due to consecutive drought especially since 1997. Decrease of available water has accelerated desertification and depopulation in the region. Since the region has left behind development among several regions in Morocco, improvement of farm productivity is essential to secure living conditions in the rural area, especially for the communities scattered in the region.

In formulating regional development plan, the Government puts emphasis on community development through "capacity building" of beneficiaries. Experience, knowledge will be a strong base for future development. Interdependence system has been established on the basis of mutual reliance between the Government and communities. 1) Faithful response to beneficiaries' needs and 2) equal opportunity to access to the governmental support program, these policy directs farmer's motivation to self-reliance on irrigation management, consequently it mitigates devastation of social system and harnesses the solidarity of rural communities.

This paper presents of the Government of Morocco agricultural and rural development policy in the arid region located at the southeast of the Atlas Mountains. The Japan International Cooperation Agency (JICA) has completed the Master plan study in the Tafilalet region under the technical cooperation program, and the author, study team presents lessons of policy-makers on how they have been coordinating rural

1, 2, 3: Nippon Giken Inc. (JICA Study Team) Kokuryu-Shibakoen Bldg., 2-6-15, Shibakoen, Minato-ku, Tokyo, Japan, Tel. +81-3-3438-1333, Fax. +81-3-3438-1455, E-mail address ta-kato@npgk.co.jp

development schemes in arid region. On the regional level, there are 40 Provincial Agricultural Directrates (DPAs) and 9 Regional authorities of agricultural development (ORMVAs) under the Ministry of Agriculture, Rural Development and Sea Fisheries. The ORMVAs are called upon to promote and implement development schemes for the improvement of agricultural productivity, supporting service for farmers. The ORMVA/TF (Tafilalet) has its service area located in the Tafilalet region. The study area (Tafilalet region) is indicated in Figure 1.

1. INTRODUCTION

In arid regions, water is most essential factor influencing small-holder farming systems. The study area, Tafilalet region is located southeast of Atlas Mountains and has annual rainfall of 50 to 200 mm. Comparing to surface water use such as rainwater and perennial river flow in the west regions of the Atlas Mountains, torrential flow and subsurface water are solely available for irrigation and potable water use in the region. Subsurface water is utilized by pumpage or subsurface tunnel structure, which is called the "khettara", widely recognized as a qanat, karez and foggara in East Asia, Middle East and North Africa. Typical section of the khettara system is illustrated in Figure 2 The farmers have been maintaining water right for several hundreds years and established firm operation and maintenance system of the khettara, however it became difficult to maintain the system as well as the rural community life as such due to water shortage and depopulation in the region.

A khettara community has been established based on individual water user group. Recent inventory study by the JICA study team indicates that there are about 410 khettaras with total number of the 241 khettara villages, 17,100 households and 129,500 population in the study area. The ORMVA/TF has been implementing several support programs for the community development considering great account of giving an equal opportunity to access to the development scheme by the government, i.e., khettara rehabilitation, flood irrigation and communal pump station construction in the irrigation sector.

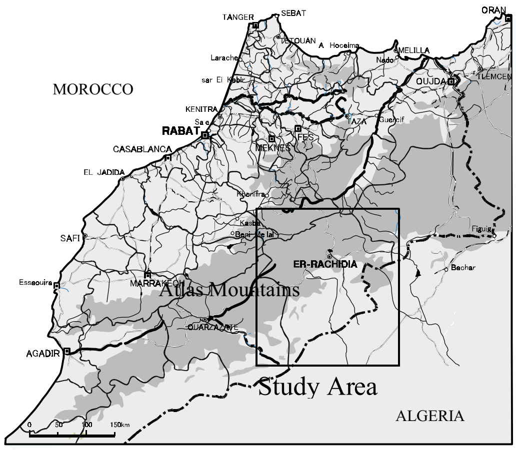


Figure 1. Location of the study area

2. HISTORY OF ACCESS TO WATER RESOURCES

There exist several water resources of surface and subsurface water origin. Surface water is utilized through dams and diversion weirs, and groundwater is exploited by pumps and gravity system of khettaras. More than 60 diversion weirs have been constructed in major streams since 1960s to divert flood water into farmland for irrigation, however its further development potential remains limited since few weir sites were proposed considering the overall water resources amount in the basins. It is often observed in surface water use, irrigation water is limitedly utilized in farmlands located along the rivers (wadi), and other areas far from the rivers have been deprived of the water resources development as well as social investment. In addition, continuous drought resulted in decease of farm products for several years since 1970. To cope with these situation, groundwater use through pumping was accelerated to secure water supply for irrigation since 1980s, however rapid shifting to pump irrigation further caused continuous decline of groundwater table due to excessively large extraction. Drawdown of water table to more than 50 m deep from the ground surface caused high fuel consumption, consequently many farmers discontinued farming within a few years after pump irrigation was excessively developed in the beginning of 1990s.

Besides these problems, regional disparity of social investment left many khettara communities behind the development and severe drought accelerated depopulation and devastation of social system of the khettara communities. To preserve the social system as well as the natural environment, such as groundwater, the ORMVA/TF has launched the khettara rehabilitation program in region-wise. Table 1 shows water volume of various water sources in the area. It is noticeable point that water through khettaras provides about 38 percent of total water supply, and whole groundwater use including pump-up water is beyond dam storage water in recent years. Since surface water excessively depends on flood occurrence, unstable climate reduces farm production. This fact advocates for re-appreciated of khettara water use because of its stable flow condition through the year.

Table 1. Water volume in the study area

	Dam[1]	Diversion weir[2]	Pumpage[3]	Khettara[4]	Total
Water volume (MCM)	80	28	11	73	192
Percentage (%)	42	15	6	38	100

Source: 1 Hassan Addakhil dam (2003/04) Study report, ORMVA/TF

2 3 major diversion weirs (2003/04) Study report, ORMVA/TF

3 Yield of 360 pump stations (2000) Ministry of Equipment and Transports

4 Yield of 191 khettaras (2005), JICA study report

3. PROCESS TO PARTICIPATORY IRRIGATION MANAGEMENT

3.1 IRRIGATION BY KHETTARA WATER

Inventory survey indicates that the productive khettaras have decreased to about 190 khettaras at present compared to about 570 khettaras in 1970s because of decrease of discharge. The average discharge of 190 khettaras is only 5.9 lit/sec, and some communities have already migrated to urban area because so little water could not sustain their living.

In the meanwhile, farmers make efforts to effectively use water for irrigation, for example, the rotation irrigation corresponding to the traditional water right is applied to water distribution of khettara water for 24 hours. Although some farmers have water right of only one hour or less in two weeks, they distribute water to their farmlands under kerosene lamps even in cold midnight in winter. For maintenance works, farmers periodically remove sediment and protect gallery and vertical shaft wall at their own expenses. Farmers abide by the local rule agreed on with adjoining khettara groups to equitably draw water. Local rule restricts extension of gallery, degradation of gallery bed and pump installation upstream of mother well so as to secure water flow of each khettara. A little financial support will increase irrigation water by reducing leakage loss, and lighten financial and laborious task of maintenance works for khettaras and irrigation canals.

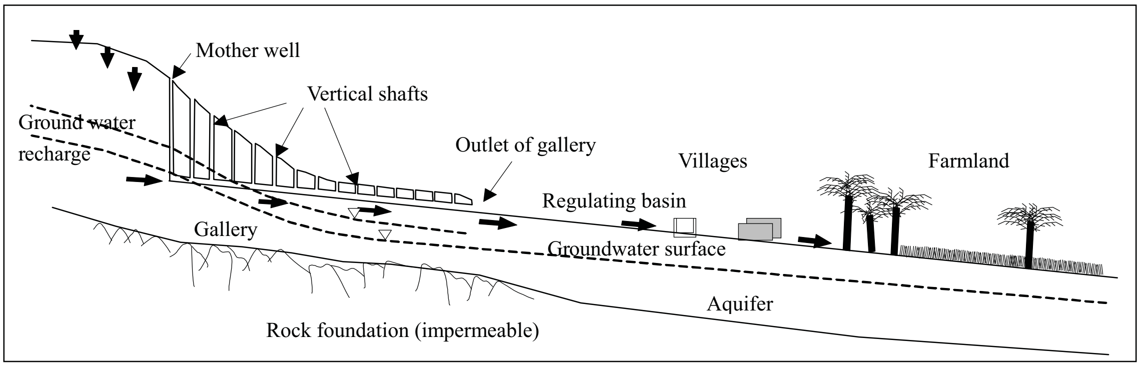


Figure 2. Schematic diagram of khettara system

3.2 IRRIGATION MANAGEMENT

In general, Government adopts participatory irrigation management to 1) reduce the dependence of farmers on government, 2) improve sustainability of irrigation systems, 3) improve efficiency and cost effectiveness of government expenditures, 4) improve agricultural productivity and so on, and for these purposes, Government would give higher priority to projects that are economically vital. On contrary to this, the ORMVA/TF has selected khettara communities without a clear distinction, e.g., water availability, number of beneficiaries and farm productivity during project implementation. Budget has been equally allocated for whole communities even though some khettaras have less water flow and locality have been severely depopulated.

For irrigation and community development, "mutual reliance" between the Governments and beneficiaries is essential to realize participatory management. The ORMVA/TF constructed diversion weirs and communal pump stations to equally distribute water to all beneficiaries, but not to individual beneficiaries. In addition, the ORMVA/TF has launched khettara rehabilitation works with close communication between farmers groups. Upon the request of the community, the ORMVA/TF willingly provides technical support including topographic survey, discharge measurement gratis. Beneficiaries steadily continue maintenance works so as to provide maximum benefit for their farmers groups. The emphasis must be on participation of government and beneficiaries, and a bottom up approach that harnesses the solidarity of rural communities. Rural development must be local and community- driven within a coherent framework. Table 2 indicates typical approach by the ORMVA/TF observed during the study:

Table 2. Activities of the ORMVA/TF and beneficiaries

by ORMVA/TF		by Farmers
1) Instruction of irrigation method to the farmers including water saving and rotation methods aiming at improving water use efficiency	↔	1) Preparation of water right paper to show present condition of water supply schedule to the engineers of the ORMVA/TF
2) Consultation of rehabilitation method of khettara and irrigation canal from technical and economical points of views	↔	2) Periodical maintenance works such as dredging of sediment and gallery protection by their own expenses
3) Rehabilitation works including material supply in emergency	↔	3) Investigation of the facilities and procurement of labor force for maintenance
4) Capacity building of farmers' groups and dissemination of farming skills	↔	4) Actual activities of income generation and extension of farm skills to neighbors through farmers' groups
5) Introduction of support programs by local and international donors	↔	5) Establishment and strengthening of farmers organizations (Associations)

3.3 FORMULATION PROCESS OF THE ORMVA/TF

The ORMVA/TF is composed of five (5) Departments and ten (10) Sub-Divisions, and closer to beneficiaries, 22 Local development centers that provide extension and support services to the farmers. In response to the information from Sub-Divisions and Local development centers, the Departments allocate annual budget for 1) planning and program service, 2) equipment procurement and management of irrigation and drainage network, 3) agricultural production service, 4) extension of institutional service, etc.

The ORMVA/TF emphasizes importance of participation of farmers to realize region-wise community development, thus irrigation and agro-industrial support programs are extended to all communities. In the small- medium irrigation program for surface irrigation canals, communal pump installation and khettara rehabilitation, capital amounts of half to one million US dollar has been equally distributed to the communities every year since 1990. As for khettara rehabilitation, the work has extended to most of the khettara systems even though rehabilitation length was limited to several hundreds meters against overall length of several thousand meters in each khettara. Almost the same budget was input for agro-industrial schemes such as date palm and vegetable cultivation, animal production, food processing, etc. Extension service by mobile team was offered to beneficiary secluded population in remote mountainous areas. Experience, knowledge of farmers' groups accumulated through their activities will be a strong base for future community development. 1) Response to beneficiaries' needs through dialogue between farmers and 2) distribution of benefit to all communities, this policy enhances farmer's motivation to self-reliance on irrigation management, consequently it mitigates devastation of social system and generates a communal society in regional level. Figure 3 indicates flow of formulation process for khettara rehabilitation scheme.

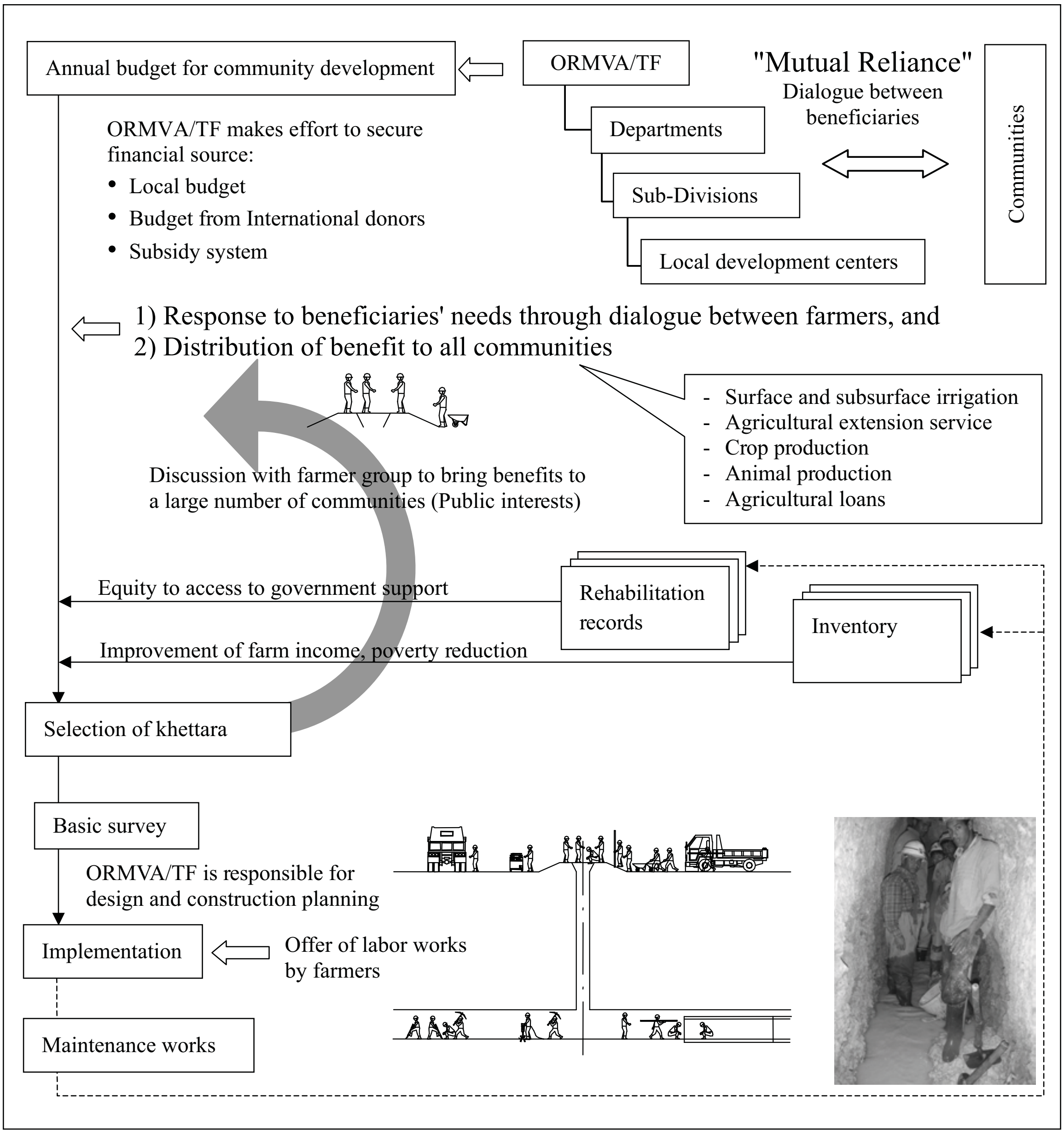


Figure 3. Formulation process of khettara rehabilitation scheme

4. ACTIVITIES OF JICA

In line with the development strategy of the ORMVA/TF, the Master plan on khettara rehabilitation and rural community development was formulated by the technical assistance program of the JICA. Following studies were conducted to verify relevance, effectiveness of the proposed components in the Master plan:

1) Technology transfer on khettara and canal rehabilitation method
2) Water saving irrigation (furrow, drip irrigation) to maximize irrigation efficiency
3) Improvement of farming skill to boost agricultural productivity (cultivation of cash crops, compost production, etc.)

4) Food processing and animal husbandry as income generation activities (date palm and vegetable processing and rabbit, pigeon breeding)
5) Improvement of rural life (improvement of water quality of khettara, public health and hygiene)
6) Capacity building of the ORMVA/TF and farmers' groups (Water Users Associations, women groups, etc.)

Before the study, the farmers scarcely accepted new farming skill and also did not put their income into irrigation and agricultural investment because benefit obtained from investment was uncertain. In the course of study, the farmers could directly see visible impacts, i.e., increase of khettara water, high crop production as well as market value, then they recognized new farming skill and positively joined to workshops and seminars. It is lesson learned that giving a trivial motive to farmers is most important to accelerate their activities, and the Government should prepare certain program that decrease financial risk on the farmer side, including subsidy scheme.

Through workshops and study tours held by the study team in the field level, farmers not only learned farming skills but had an opportunity to participate several governmental supporting programs, which had not been widely prevailed throughout the region previously. Both Governments and farmers have begun to put in serious efforts to cope with several constraints for development of oasis agriculture. With strong support by the ORMVA/TF, the farmers can have many opportunities to receive governmental assistance and their opinion shall be reflected to the Government's strategy.

Photo 1. Discussion with beneficiaries on khettara rehabilitation method

Photo 2. Exchange of opinions with beneficiaries on water distribution method

5. CONCLUSIONS

Khettara system resembles tertiary canal of a large irrigation system in end water distribution system. Poor operation and maintenance of the tertiary canal causes lower water use efficiency as commonly observed in a large irrigation system. Contrastively khettara system has been well operated for several hundreds years because community itself was established on the basis of khettara water. Khettara and irrigation canal are maintained periodically according to the water right. The Government respects their self-reliance and provides technical and financial support within the extent of his autonomy. Since khettara flow is indispensable to maintain communities in arid region, it is desirable to improve present situation through efforts of local people with assistance of local governments considering the major significance of the khettara rehabilitation, i.e., 1) less cost and safer water sources, 2) sole water source for stable agricultural production, 3) source to preserve social system, and 4) heritage for the future.

Since each community is economically weak and vulnerable to climate change, community is expected to expand his activities to other communities based on their accumulated trust with local people and ability on managing and coordinating development works in the community. In the light of these facts, it is expected that the Government will continuously support communities and unify them into more large organization such as "communal society" to stabilize and increase farm income of the rural communities under their initiatives.

SUSTAINABLE PARTICIPATORY IRRIGATION MANAGEMENT

Mirshoja Mir Charkhchian[1]

ABSTRACT

To make proper decision on irrigation management transposition, "sustainability in irrigation management" and specifically participatory irrigation management, which is the result of transposition program should be taken into consideration.

In irrigation management transposition process, as the management transposition mechanism and the assured responsibility delegation method are important, the sustainability and persistence of activities are the main issue. Specially, since the stakeholders as the future caretakers for operation and maintenance of irrigation installations do not have enough experience for the acceptance and performance of the given responsibilities. Therefore, the persistence of these activities in the form of new operational system, which is the subject of sustainable management, is focal point of the transposition program.

The main elements in the sustainable participatory irrigation management are:

1) Strategies;
2) Training and Extension;
3) Monitoring and valuation.

In all the three abovementioned main elements, it is recommended that the rational advisory models to be substituted for the common governmental trends, which requires:

- In policymaking, new guidelines with no consideration for administrative caution, but correspond to requirements of local developing society to be submitted;
- In training and extension, in addition to formal education in agricultural and irrigation activities, the issues relevant to reconciliation of technical specifications of the network with social requirements of an operation unit to be clarified for the stakeholders.
- By the assistance of a specialized support system (e.g. in form of a non-governmental specialized/advisory organization) a diligent plan for monitoring and valuation of the performance of modern management to be designed to

---

1 - Senior Expert in Social, Economical Department, Yekom Co., B.Sc. in Management
Email: shoja.charkhchian@yekom.com

overcome the conditions resulted from establishment of the participatory operational policy instead of the past one.

In this article, each of the main effective elements of sustainable participatory management have been analyzed, the limitations and strength points described along with the required organizational relations

Key Word: Sustainable Participatory Irrigation Management

PREFACE

With implementing irrigation management transposition program from public sector to private sector and forming participatory irrigation management which the stakeholders (agriculture stakeholders) are involved in organizing the operational affairs and maintenance of irrigation network, a significant stage in management is commenced. Proper forming of participatory management and rational continuation under the expected efficiency is the sustainable and continuation issue in participatory irrigation management. Achievement of this issue is a test for the accuracy of decisions made for the method of management transposition.

In transposition plan, not only the management transfer mechanism and the method for granting responsibilities and planning for support from transfer process is very important but also endurance of operation managing from the network in the frame work of participatory irrigation management has a twofold importance.

The sustaining issue in management by stakeholders depends on 2 general factors and includes" continuation of activities" and "activities efficiencies". Considering lack of necessary experiences in the important issue of irrigation network managing by stakeholders in the past, we must always be aware about unexpected issues or those which are out of transfer program mechanism. Even, the system may face pause or recession in its activities.

Every above general events in the process of participatory management is directly related to "Sustainable Irrigation Management" and therefore to prevent the above issues and assurance of "Sustainable Irrigation Management" some elements must be considered to help to be far away from them and help to achieve the sustainability. These elements which are the base for sustainable irrigation management in transposition plan include: policymaking, training and extension, monitoring and evaluation. It is necessary that in each of the above mentioned elements, advisory intellectual models substitute the common public frameworks; therefore, public organization should pave the way for the following fundamental steps in order to utilize the above elements properly:

1- Adopting modern strategies with assurance of advisory method and accepting the role of mere supervisory, away from administrative expediency
2- Providing a new educational plan (separated from the formal education related to agricultural activities) in order to make required changes in arranging land sections in an adoptable framework of network technical specification with social necessities at irrigation unit.

3- Using specialized support system and assistance of non public specialized and advisory organization, preparing and executing the required plan for continuous monitoring from participatory management efficiency. In this way, the deficiencies will be recognized and solved by the stakeholders. So, it is possible to confront the probable impacts caused by substituting the participatory operation policy instead of past traditional system

MODERN STRATEGIES IN POLICYMAKING

The existing experiences in transposition of irrigation management defines that in making basic decisions related to policy making in design and establishing modern irrigation network and assign the management to stakeholders, one aspect is just

considered. It means to explain the predestined objectives only one of the multiple aspects in the complicated issue of making and managing network is considered. For example, among the financial policies, only "providing share of financial cost for plan stakeholders" is the focal point or it is possible to consider the fixed and inflexible rates for water cost.

Regarding organizational policies, it also emphasizes merely the role of public executors within the system which is apparently private while this role can be assigned to a non governmental supporting and specialized company or expert consultants.

One-dimensional observation represents not only in financial and organizational constraints but also in the shape of financial allocation on areas which does not have efficient role but just supportive one in the system implementation

.The dominated view in providing financial resources in establishing operational participatory management is out of integrity, but It doesn't mean that no organizational decision is taken in this regard .It means that these decisions are entitled to change during the design and implementation period.

In the financial participation of irrigation network for Aidoghmush dam downstream lands (East Azerbaijan-Miyaneh city), the financial participation share of stakeholders in ha. has been changed repeatedly to provide minor network costs. This issue left unsuitable effect in social studies at second stage (design stage) and making ground for mutual trust with stakeholders in order to specify later steps.

According to organizational view, policy makings depended on short time decisions and no attention was paid to the suggestions of plan consultant in making future steps for implementing "Action options" which clearly will cause to make a role "social supervision" in shaping and making participatory management cores from the consultant.

Another aspect of one-dimensional observation in policy making is the way to determine plan regions and prioritizing the regions (agricultural plains). In determination of irrigation regions, the downstream lands and water right holders are generally considered. Of course, this measure is right based on agricultural and technical aspect but, for policy making only one aspect of social issues is paid attention. For prioritizing to plan regions, is there a need for social study of the neighborhood plains? Are parameters like income sources, employment groups, population changes, irrigation crisis and race and regional prejudices considered?

In this way, it is observed that in the policy for determining plan regions; Since it is possible that priorities may be given to the neighborhood and downstream plains of the selected plain through more exact studies; considering direct and water right holders' plains which the studies are not merely focused on them; might not be enough.

Other aspects related to policy restriction and obtaining effective policies are the policies on network execution (before management transfer). One of these policies' strength points is to meet the time schedule for network establishment based on what the project consultant has promised in the social studies with stakeholders.

Implementing networks which are taking a long time from their commencement cause hopelessness and indifference in the stakeholders' society. Moreover, with social changes (migrations, access to non agricultural income sources, and changes in the land use) the required factors to take the network control and utilization by stakeholders will be faded and it causes disorder in the network proper function by aware elements.

Considering the existing restrictions and weak points in policy of the plan and network establishment and also preparing plan for irrigation management transposition, the strong points which through these policies shall be obtained; are completely distinguished

Table: Some of the main policy makings for plans making and transposition program

Policies	One-dimensional and restrictive policies	Overall policies with strong points
Organization policies	Without interference of stakeholders and non public experts in policy making chart and making decisions by the expedient elements	Accepting advisory role in organization chart of plans and organizing planning and strategy committees with participation of all the stakeholder agents, including the pioneer elements in stakeholders society
Financial policies	Insist on the stakeholders financial participation share based on the dictated rules without considering the region condition and analyzing the results caused from the cost and income and analyze the subsides role in providing financial sources for managing the installation	Establishing financial policies based on stakeholders real participation and considering the regions conditions and analyze the relationship between cost and income , also considering to the role of subsides especially during the participatory management period and it's impact on maintenance cost reduction
Plan policies (Executing)	Taking long time in executing period and stakeholders no trust to the plan results due to the changes caused from the long period of time	Making decisions based on observing the time in plan execution and controlling the social changes during the plan making with the goal to attract stakeholders trust

Policies	One-dimensional and restrictive policies	Overall policies with strong points
Regional priority policies	Lack of recognition the immediate needs in the regions without considering the neighborhood regions impacts and emphasis to the plan technical necessities	Priority to the real and immediate needs of the regions and considering the multi dimension models in specifying the plan regions with the aim to prevent social tensions
General policies in transposition periods	No fundamental and obligation making perception about the sustainable changes in irrigation management and accepting the participatory irrigation management without attention to the pioneer elements and advisors and without their interfere in the continuation of the management	Making general policies based on strong and fundamental political preparations and attention to the role of pioneer stakeholders to attract the cooperation of general stakeholders during the transposition period and after it.

DIFFERENT ROLE OF EDUCATION AND EXTENSION IN ESTABLISHING PARTICIPATORY IRRIGATION MANAGEMENT

In the area of related issues to education and extension of irrigation participatory plans, we still involve in normal levels in irrigation and agriculture development which include educations related to learning new pattern of agricultural products in development plan with involvement of production modern technology. Also, trainings about familiarity with equipments and repairs and maintenance of installations are the other part of education and extension which is common in irrigation and agricultural development plans.

The main point in this regard and related to development in modern irrigation network is lack of necessary understanding from congruence of network technical specification with existing social necessities in traditional irrigation which has been constructed on the scattered, various and small farming lands. In fact, this case is regarded as one of the signs of challenge between the modern operational policies and traditional operational policy from agricultural farming lands. If this conflict will not be solved or be considered very skin deep and with dominant of technical aspects in the network construction, consequently the network operation will jeopardize especially in conditions where the participatory management in the network operation is expected to be applicable.

Nowadays, engineering design in constructing side canals at irrigation networks will be paid more attention. Such a design doesn't pass the farming section borders and inevitably, it separates parts from operation unit under different irrigations. Therefore, parts movement and change in arrangements of users' farming parts based on engineering design necessities; will be in the work order which can be referred to as "Land Integration ".

Also, in any irrigation unit, the parts movement issue and integrating the consumer parts of any irrigation unit; may be discussed due to in any of the above cases, the borders of farming units might be ignored.

One of the other related issue for facilitating the operation of irrigation modern network which is necessary to be trained to the consumer groups for, is "consolidated farming" which recommends unit cultivation in selected regions. The use of this issue is the irrigation way and providing required water for plants and also cultivation, husbandry, harvest and other measures in producing agricultural crops.

It is observed that the educational and promoting methods are very wide scope and will go beyond the classic trainings related to method of consumer's activity under the new agricultural pattern and the way to use the irrigation equipments.

Acceptance of above terms from the users needs their familiarity with this issue in the process of "participatory field operation" by consultants. It is necessary that the project consultant precedes the work simultaneously with network design and even before that using the device for field operation including cadastral map and irrigation unit's map and having dialogue with stakeholders.

Familiarity and acceptance of this issue by stakeholders follows a difficult process. Also, its practical implementation requires making a separate training and disseminating process. Meanwhile, if there would be no attention in this regard, we will face that the stakeholders refuse organizing the participator operation system and during the existing operation stakeholders do not accept to cooperate for acceptance of the necessities caused from adopting network technical circumstances and existing problems to settle scattered lands in the traditional operational policy. In this way, continuation and endurance of participatory management system will not happen and network operation deficiencies will happen at any time and causes costs increase shortage of resources and nullify the activities. Generally, the neglect of this issue is considered because of existing limitations in understanding and acceptance of stakeholders with these changes and developments while its implementation is considered as the strength points of base making in irrigation participatory management.

Required organization relationships in this regard, are defined based on theoretical and providing executing strategies in the framework of contract consultant in the first and second stages of irrigation network studies. In the execution stage and in suggested options, the contract consultant will have social supervision on it too and the most effective device for achievement is considered devices in participatory field operation.

In transposition plan and in the process of participatory management process, a mechanism should be designed to include this functional issue into the duties of a "non governmental supportive specialized and technical company". In other words, it is related to the role of "consultants".

The required time in first and second stages of project and submitting extension and training plan for it, will comply the time table offered by the contract consultant. In this way, at the end of the second stage and providing strategies for "Action options", training and execution operation titled "Executive strategies for adopting way of irrigation network technical necessities with social obligations in utilization unit" will be compiled and implemented under consultant's social supervision.

MONITORING AND EVALUATION AS SUSTAINABLE FACTOR IN PARTICIPATORY MANAGEMENT

One of the meaningful definitions for the word "Monitoring" is "to care". This word in the activities related to irrigation management means to care the affairs related to utilizing from irrigation installations in a way to achieve the necessary efficiency based on program goals. By this definition, it is clear that controlling tools must be used to solve deficiencies and recognize the lack of probable operation on time. It is natural that this measure is easy by appropriate and updated report and circulation of affairs. So, observation and reporting are among the effective device in monitoring.

Effective monitoring is along with evaluation, so, evaluation of issues requires use of other devices such as carrying out " participatory field operation", distributing written questionnaire and special forms among authorities and stakeholders in utilizing from the network for informing and evaluating the responsibilities and efficiency of the affairs.

With these explanations, the value and importance of monitoring will be identified in continuation and effective endeavor of irrigation participatory management. So, without these measures and in lack of information and without controlling the issues,

The effect of improper activity and deficiencies, participatory management will face serious danger and in this way it would be without continuation and endurance.

MONITORING AS MAJOR FACTOR IN MANAGEMENT TRANSPOSITION PROGRAM

Monitoring program, organization and its implementation mechanism must be considered as parts of strategies for management transposition program. It should not be considered that after transposition, it is possible to design the mechanisms of a monitoring program from participatory management activity. The monitoring program should be considered as part of the preparations for implementing transposition program.

THE ROLE OF LABOR ORGANIZATION, TIME AND NECESSITIES OF MONITORING MEASURES

Selecting authorities and elements who are the executors of monitoring program; are acknowledgeable points. In labor organization of monitoring program, "Network Designer Consultant" and "Social observer consultant" and stakeholders pioneer agent must be involved. Also, experts as neutral parties; who directly didn't have a role in management transposition program can attend as the chief supervisor for monitoring affairs.

Selecting proper time (regular and irregular) is very important in monitoring. For example, annually and monthly monitoring can be considered and a special development in management causes monitoring program.

Also, to select monitoring issues, attentions must be paid to the necessities in approaching some sensitive aspects in network management and to separate those items which are in priority and are more important. In this regard, the necessary issues might be asked from the authorities.

THE CAPACITY TO USE MONITORING RESULTS

In order to use monitoring program design in solving functional defects of irrigation management and its sustainability, study of effective issues in monitoring must be used and in this way we can obtain information which are functional and avoid the extra and unnecessary information. For example, wasting water issue, delay in access to the water in due time, costs estimation & it's comparison to the past, stakeholders familiarity with the participatory operational policy and the facilities and irrigation, observing cultivation pattern and related trainings, the stakeholders general satisfaction sense from the network function and their familiarity with the responsibilities in water user groups and etc. can be the principle issues in monitoring and also be effective in evaluating management work.

EFFECT OF MONITORING INFORMATION IN SOLVING THE DEFECTS

The information obtained from the monitoring measures must guarantee achievement to the development tools in order to change the procedures, instructions and the current management activities. If this task is not accomplished, the monitoring has not been purposeful and will divert to an administrative issue with spending useless costs.

The easiest example in this regard, relates to the maintenance and operation of equipments. The result of monitoring must show that something like efficiency drop off in network operation is related to the lack of control by network operator in a certain division like reservoirs or it is due to using defective parts, so that the problem can be resolved & fixed.

In more complicated levels, the results of a monitoring program may show that in participatory policy and stakeholders following the agricultural modern pattern and using the modern irrigation network, the stakeholders have faced income reduction. So, obtaining information about the causes of this deficiency can be achieved through an appropriate monitoring program. For example, the loan installments and water bills might be high, the network is always repairing and in break down condition, the sufficient water is not supplied and the crops faced with low artificial irrigation. Agricultural pattern and production technology are not observed; also the group's management does not have suitable operation. It is even possible that operational groups in construction levels or water association influenced by the foreign pressures to issue procedures and instructions which have affected the natural process of participatory management operation.

The abovementioned issues show that specific information about the lack of success in participatory management operation can help the authorities and stakeholders in problem solving.

THE MAIN TOOLS IN IMPLEMENTING MONITORING PROGRAM

To achieve proper results in monitoring program and using it for overcoming the deficiencies based on the sustainability of participatory management, applying necessary and effective tools in monitoring and evaluating the irrigation management operation must be considered.

One of the suitable tools in team conversations is based on "Participatory Rural Appraisal (P.R.A)". In this method, the possibility to express the stakeholders' problem cause to achieve variety of comments, ideas and related characteristics to participatory management operation provided that we can represent a correct conclusion from comments and events in our minds. Especially, as the conclusion from the events is in line with the irrigation management operation, consequently the existing sensitivities in accuracy or inaccuracy of the achieved assumptions among the stakeholders' comments and related events of participatory management shall be considered.

It is possible to consider quantity changes and developments in monitoring measures, in a way to use them in evaluating the irrigation management activity as merely getting information from one or some issues are noticeable. In this case, an information form (Field questionnaires) or forms to interview people and authorities must be designed to obtain the information of system operation. Other considered tools are "Observation" and "Discovering ambiguous issues"(General method in field studies) in obtaining special issues.

In each of the above issues, information about the history of irrigation network establishment, irrigation management shaping and goals, general information about the region (General method for organizational studies) are important for the monitoring authorities and is considered as the monitoring tool.

The mentioned issues can be shown in the table below in brief:

Goals, Characteristics and Effects of a Monitoring Program

Objectives of monitoring	**Characteristics**	**Impacts**	**Tools**
Monitoring as one of the transposition program rounds	Foresight in operation of participatory management	Prevent from improper operation	Monitoring guide in the transposition program documents
Recognizing the existing necessities for monitoring in management operation	implementation timing controls (regular & irregular) in certain cases	Increasing management care and attention	Tangible and intangible inspections
Access to useful information from the management operation	Controlling the management operation	Evaluating management operation	Completing questionnaire and information forms and conversation with stakeholders
Perform monitoring to be used in solving the management defects	Purposefulness of monitoring	Access to the defects in the irrigation management operation	Implementing participatory field operation

REFERENCES:

1- Esmaeel Jabari, Lessons from transposition approach "irrigation networks management to farmers" Third technical workshop for water user participation in irrigation networks management, Feb. 2003

2- Iran national drainage and irrigation committee, Translation and compiling "Monitoring and evaluation guide in transposition of irrigation management" No. 56, 2002

3- Yekom consulting engineers, Results of economical, social studies and operational policy in downstream lands of Aidoghmush dam, 2003

PARTICIPATORY EXPERIENCES FOR ENHANCING LAND AND WATER PRODUCTIVITY

Atul Kumar Singh[1], A. K. Sikka[2], A.Upadhyaya[1], P. R. Bhatnagar[1]

ABSTRACT

This paper shares the experiences of a project having measures to facilitate the formation of land and water management strategies and institutions that are socially acceptable and broadly replicable. The paper describes the participatory process developed and adopted for exploring options for better use of water with focus on a single distributary RPC-V (Right Parallel Channel – V) of Patna Main Canal system under Sone Command through cost effective participatory mechanism, involving poor farmers, landless and share croppers. A key difference in our approach has been the identification and elaboration of possibilities of bringing improvement through dialogue with poor and marginal stakeholders empowered in relation to the larger-scale farmers who traditionally dominate the on-farm water management (OFWM) through self-help groups (SHGs). Dialogues were initiated between experts, local communities, and other key stakeholders such as the Irrigation Department. Emergence and role of Outlet Management Groups (OMGs) and Self Help Groups (SHGs) during the project period provided an interface to explore opportunities for efficient land and water management. The overwhelming response from the community has clearly demonstrated that the involvement of wider constituency of stakeholders provided good opportunities for the adoption of need based OFWM technologies, leading to more effective participatory irrigation management (PIM). Adoption of need based, low cost interventions such as raising of bund height for rainwater conservation, optimization of

Rice transplanting time, multiple water use and productive utilization of seasonally waterlogged areas, and selection of pumps for lifting ground water by the farmers using their own resources was a testimony for the success of the participatory process. Recognizing the need for establishing linkages between the OFWM and main canal system management, a broader framework between water users and canal managers is suggested. Strategies for scaling up are also discussed in the paper.

1- Senior Scientist, ICAR Research Complex for Eastern Region, WALMI Complex, Phulwari Sharif, Patna – 801505, Bihar, India
2- Director ICAR-RCER

INTRODUCTION

Numbers of innovative approaches to agricultural and rural development have emerged in recent years. Some of these have developed within the official agricultural research community having “Top to Bottom” approach, while others have been developed within non-governmental organizations (NGOs). Each has their own strengths and weaknesses. It has been observed that where official sector had competence in formal science and technology developments the NGOs have more concentrated on socio-economic front. Experiences show that peoples’ participation has been identified as one of the major principles for sustainable development of the critical resources land and water. This reflects to believe that people who inhabit an environment over time are more competent to make decisions. Farming Systems Research, Training and Visit systems of agricultural research, On-Farm Water Management, and Command Area Development were some of the dominant approaches in the 1970s through the 1990s in India to enhance land and water productivity (Anonymous. 2002, Joshi. 1997). In the process it has been realized that these process lack in involving resource poor farming communities with an assumption that either the technologies did not suits to them or that the methods of contact and communication were biased against success. These diagnoses helped in offspring of new approaches which included Farmer Field Schools, Institute Village Linkage Programme (IVLP), micro-finance and rural livelihoods initiatives besides gender and environmental aspects. Further recent trends to involve private sector and NGOs in official development interventions, have opened new beginnings in inter-institutional partnership for development and growth of resource poor farmers.

The premises of this study was that there are multiple interlocking obstacles to development from environmental, socio-economic and institutional factors, but recently-developed technological and institutional innovations can be brought together in a way so that not only productivity but also livelihood of the farming community through new knowledge of land and water management practices. The idea here was that, given the high potential but low productivity of the project areas, potential economic gains from increased productivity could offer resources and incentive in institution building for irrigation and agricultural development process leading to higher productivity and improved livelihoods.

The study was designed around the ‘on-farm water management’ (OFWM) idiom built on the diagnosis that irrigation problems lay ‘below the outlet’ with typical top-end/bottom-end distribution problems leading to inefficiency and inequity in water use (Sikka et. al., 2004). As the average cost of canal water in India is less than 5% of the value of the crop it is used to produce. During 1989-90, the average revenue collected from canal water users was Rs.50/ha whereas the average cost of canal maintenance was Rs.270/ha. Low irrigation rates and increased establishment charges result in neglect of canal maintenance leading to infrastructural deterioration, unreliability, excessive water losses, social conflicts and low agricultural production. Water conflicts are common in most of the systems, leading to vandalism and disruption of the physical facilities and degradation of the system. Participatory Irrigation Management (PIM) has been proposed as a way to improve water management in canal commands (Vermilion et. al. 1995). However a slow and steady approach towards PIM in India has been recommended with a caution that it is not the panacea for all the difficulties. Under PIM the formation of WUAs is governed by the Government of India CADA policy guidelines on Participatory Irrigation Management. In general these guidelines specify a two-tier system in the form of a WUA covering a group of outlets or a minor and a Distributary Level Committee (DLC). In Bihar there are DLCs and Village Level Committees (VLCs). Typically these committees involve and focus on the interests of land-owning farmers. Whereas, the key hypothesis of the study was that by including a wider constituency in decision making related to canal management, agricultural productivity would be improved. During the process of dialogue it was realized that interest of water users at out level are not being represented well. This required formation of some types of groups who can take responsibilities for sharing and distribution of canal water. After continuous discussions with existing WUAs and other community members it was decided to form OMGs (Outlet Management Groups) at every outlet who will not only act as a bridge between the water users and WUAs but also safeguard the interest of water users for timely availability of canal water. The awareness amongst the community resulted in formation of OMGs nearly at every outlet within six months having 5 water users as committee member. Overall under this study attempts have been taken to identify and work out ways to engage poor and marginal stakeholders and to empower them to bring improvement in land and water productivity at wider scale.

STUDY AREA

The study area falls in the eastern Indo-Gangetic plains located near Patna, Bihar, India under Sone Command. The area is hot and humid with a monsoon lasting from early June to mid October, followed by a long dry season with which is divided into winter (November-March and summer (April – June) periods. Annual rainfall is in the range of 1000 to 1200 mm, the bulk of which falls in August to September. The soils in the area are alluvium derived and vary greatly in texture from sandy to silty clay loams; lighter textured soils are characteristic of elevated areas and of the soils in the northern piedmont belt of the region. Heavier textured soils often more suited to irrigation, and yet prone to water logging, are common in low lying areas and along the major watercourses that run through the area. Surface and sub-surface drainage can be free or severely impeded; flooding is a problem in many parts of the region but the study area is partially affected.

The Sone River is an interstate river originating from the *Amarkantak* plateau in Madhya Pradesh. The Sone irrigation system was started in the mid 19th century. The Sone command is spread over five districts in South Bihar: *Rohtas, Bhjojpur, Patna, Gaya and Aurangabad*. The study area is fed by RPC (Right Parallel Channel) – V which is a distributary of Patna main Canal System under Sone command. The RPC-V was originally built to irrigate in the dry rabi season, but intensive developments were undertaken in the 1960s including a new barrage, and remodeling of the main canal system and its distributaries etc. to meet increased water demand. The culturable command area of RPC-V is around 2200 hectares covering parts of 20 villages in Naubatpur and Bikram Community Development Blocks. Many of the villages with land under RPC-V are split by the main canal with some un-irrigated higher land to the north. Given the general slope of the area to the north-east, RPC-V drains to the south-east and tail-flows drain into an ahar that runs from around Danara village in a north easterly direction along the lower end of the CCA before debouching into a large *Ahar* nearby village Baiduli which drains immediately into the Punpun river, and then meets the river Ganges to the west of Patna city. Drainage is hampered at all stages during the monsoon and even in the rabi season low lying areas near the *Ahar* that drains RPC-V can be waterlogged; at the start of the monsoon water backs up from the drainage into the Punpun and to the low lying areas in the tail villages (Rampur and Bedauli villages) forcing earlier planting of kharif rice in these areas. The higher land along which the main canal and RPC-V run has lighter soils commanded by RPC-V have more ready access to irrigation. The low lying areas towards the *Ahar* are heavier textured but have less ready access to irrigation.

PURPOSE

The main focus of the project was to develop, field-test and demonstrate appropriate strategies of land and water management practices that would lead to improved rural livelihoods (including livelihoods of poor) and make them available for uptake to target institutions. The project focuses on the promotion of low cost technologies/practices for land and water management that have proven potential to improve productivity. It sought to develop a method for undertaking participatory technology development (PTD) that could be institutionalized and sustained as part of pro-poor rural services. This contrasts with the usual use of PTD as a micro-scale on-farm research tool (Anonymous. 2004).

INSTITUTIONAL ARRANGEMENTS UNDER THE PROJECT

The project also aimed to find an efficient and institutionally sustainable way by which research professionals can work with farmers on technologies that can improve crop productivity and, through adoption, improve the livelihoods of poor including socially disadvantaged men and women.

The group comprises of a wide range of partners in the project. But the key players were ICAR-RCER (ICAR Research Complex for Eastern Region) was formerly known as Directorate of Water Management Resources (DWMR), an Indian NGO and a group of visiting scientists of Rothemsted, University of East Anglia Silsoe Research Institute, CABI biosciences (Farmer field School methods and field diagnosis) and The International Water Management Institute. Other partners have contributed to the project mostly by way of specific managerial, consultancy and training inputs.

Scientists from ICAR mainly comprises of multidisciplinary fields such as agricultural engineering, agronomy, soil science, groundwater modelling, hydrology, statistics, as well as agricultural economics and extension, whereas the national NGO had expertise and wide experience in community micro-organisational development. The team deployed by the NGO comprises of management specialist with experience in designing, appraising and operating poverty reduction programmes. By the third year, three more persons, including an agricultural specialist had been added. Several (part time) community based facilitators had been trained and placed by end of project. Similarly, visiting scientists from U. K. also comprises of multidisciplinary team had specialization in the field of soil science, agricultural economics, social science etc.

With this wide range of project partnership the project needs to develop two institutional arenas a) firstly, that of the project initiators consisting of ICAR scientists, members of an Indian national NGO, and a varied group of international scientists and development consultants as described above, and, secondly, that of the recommendation domain or target groups of rural society in study area. These then can be intersected through interventions by the project initiators in the target areas. The interactions within the initiators and the between the local community can be conceptualised as interfaces where radically different social groups negotiate understandings and transact resources. The primary interface is between the official institutions of the project and local society whilst the interaction amongst foreign development consultants, national NGO development practitioners and ICAR scientists is another interface where understandings are not necessarily shared because the social structures of these participating groups differ radically, and what will have the appearance of a joint project must be negotiated in the course of the project.

The diversity of these interfaces does resulted many times different and sometimes contending views, amongst project partners and consultants, keeping in view broadly shared objectives of developing a project within the participatory technology development agenda with emphasis on livelihoods of the poor, and action through groups of poor people. Hence the diverse partners brought to the project very different institutional, locational and theoretical perspectives towards agricultural and irrigation research development and rural society.

While most of the project participants were concerned with issues of appropriate agricultural and irrigation technologies and institutions, and how to elaborate a project to address these issues in a participatory and pro-poor, gender and environmentally-sensitive manner, perhaps the crucial issue which framed the debates leading to plans for the project was the issue of institutional scalability especially of the self-help groups whose formation was to be facilitated. A prime virtue of the participatory interventions of the type envisaged by the project was to be their self-replicability throughout the recommendation domain. Past experience suggested that such groups when facilitated as instruments of other objectives of the project (e.g. for agricultural technology development, or irrigation participation) would have no capacity for replication or extension beyond project boundaries in time and space, and indeed were likely to have a limited life expectancy after project withdrawal, or would become dependent on continued outside support involving transfers unless a new approach is applied.

PROJECT APPROACH

Initial project negotiations during the inception phase led to a recognition that a key aspect of the approach proposed involved avoiding incentivisation. Acknowledging this, no formal commitments were made between users and motivators, beyond those associated with the initial technology demonstration activities. As was discussed above the project partners came from very different positions and in the first year or more of the project activities preceded more or less independently as follows:

- Facilitation of community development activities undertaken,
- Information collection supported by field diagnosis and GIS mapping activities,
- Validation and demonstration of the benefits of early rice transplanting in R7830.

Initially to have feel of the area, basic information were gathered throw published sources, socio-economic surveys, and informal dialogue with the community members. These activities helped in identifying constraints and problems that are specific to water management and raising awareness within the team of scientists (from all partner organisations) of the field situation. At the same time as these activities were underway, the NGO partner was involved independently to facilitate community development activities. Initially these activities were maintained as discrete activities as was required by the dialectic concept. There were however significant differences amongst the project partners who wanted to form SHGs to pursue various technical and livelihood opportunities. Interventions and negotiations between the team members resolved the differences. The vision for GIS as a tool that would facilitate interaction at various levels within the project is laid out in the project inception report keeping in view that, maps are important products to facilitate communication between different stakeholders such as team members, advisors, planners, executors, and users for strategic planning and development. Besides this a large scale demonstration and field based promotion of the benefits of early rice transplanting on rice and subsequent wheat production, practicing deep summer tillage etc. was undertaken based on previous research undertaken by ICAR scientists indicating the potential production benefits of these practices (Sikka et. al. 2004).

Whilst the parallel / independent approach continued in the field, dialogue within the project team led to an agreement to trial an approach where ideas would be ‘broadcast’ and that the team would respond to expressions of interest.

PARTICIPATORY PROCESS DEVELOPED FOR WATER MANAGEMENT

The participatory process comprising of five major key elements was developed (Singh et. al.).

1. Identification of technologies and broadcasting ideas,
2. Identification of interest/focus groups/members,
3. Enhancing know-how of interest/focus groups/members through group discussions supported by quality communication product (leaflets in local language),
4. Providing technical know-how on technologies to interest/focus groups/members through on-site discussions and strategic field demonstrations,
5. Slow withdrawal of experts from study area to facilitate increased interactions amongst interest/focus groups/members with other members of the community over technologies/interventions adopted for further self dissemination.

In response to information collection and field familiarisation and feedback derived from analysis of the SHG database a series of communication products (leaflets) were prepared. The purpose of these was to raise awareness of ideas and technologies. The leaflets provided basic technical know-how. Group meetings between project staff and various groups were held in different canal reaches comprising of SHGs / WUAs and even individual farmers to discuss the advantages and disadvantages of the technologies.

The technologies identified for broadcasting (in the form of leaflets) amongst the community after series of group discussions were:

- Selection of pumps for groundwater exploitation,
- Water management in rice,

Multiple water use,

- Canal water management,
- Efficient use of rainwater,
- Water management in wheat,
- Advantages of irrigation through field channels and the importance of gates on outlets,
- Optimisation of rice transplanting

Initially promotion was done through NGO volunteers using materials developed and suggestions provided by ICAR scientists considering that SHGs had proved more attractive to poorer groups and women who were often landless or sharecroppers. It was observed that many of the options and technologies, relating to canal and water management were not of immediate interest and initial response was low incase of SHGs as they are more interested in technologies/options from which they can fetch results in shorter duration and needs nominal investment. This made to realize that though the process of facilitating SHG and community development was important but involvement of other actors within the community is also important if one envisage for overall and sustainable development of land and water on the other hand ICAR-RCER staff had experience in direct communication with representatives of this group they became more actively involved in promotion.

PARTICIPATORY PROCESS REVISITED AND MODIFIED

Poor responses of SHGs led to revisit the participatory process to modify the strategies by considering the lessons learnt during previous attempt. Major undertaken were;

1. Participatory process must facilitate the involvement of wider constituency of members belonging to SHGs, WUAs, OMGs and individual members.
2. Use of leaflet as a communication product,
3. Identifying interest/focused groups/members interested in taking up the improved interventions voluntarily.
4. Undertaking few need based strategic participatory field demonstrations and providing technical know-how on member’s demands.
5. Facilitating members for better interface and further linkages with other stakeholders including financial institutions.
6. No provisions for any financial assistance nor any commitment for future meetings.
7. Development of a self disseminating mechanism for transfer of technology.

Considering above and by obtaining members ideas through dialogue a participatory process was formulated which can been implemented for future course of actions. The basic concept in formulation of the process was to develop a mechanism through which involvement of wider constituency of community members at one platform can be facilitated for better interface in land and water management leading to effective participatory irrigation management (PIM).

The process was initiated with wider communities involving individual members, SHGs and WUAs in different reaches of the canal command. This facilitated a wide range of discussions between project team and group members and also among the members of different communities. Such discussions provided the much-needed sensitisation amongst members of the community that resulted in further invitations from members for the scientists/experts to visit their areas and to explain concepts and strengthen their knowledge through group meetings. This resulted in emergence of newer idea which are more implementable due to personal stakes of members, emergence of focused individual members and groups with genuine interest in adoption of improved technologies and development of a participatory process which follows the bottom-up process to be more sustainable. Based on discussions some interventions related to crop, land and water management were identified and communication product in the form of leaflets were developed for providing awareness and technical know-how to interest/focused groups/members. These products were distributed amongst the community in group meetings on their demand. As means of communication strategy few strategic participatory demonstrations were undertaken on farmer's field with very minimal inputs not more than Rs.100-150/- in case of multiple use of land and water in terms of fingerlings as members were facing difficulties to get genuine fingerlings were provided. These actions resulted in adoption of various interventions.

IMPACT OF THE PROCESS

The impact of the process has been threefold in terms of;

1. Defining working relation of facilitators/experts when working in partnership mode,
2. Ways forward to involve wider set of constituencies of community, and
3. Path forward for a cost effective sustainable people driven participatory process around land and water.

Activities undertaken most importantly resulted in;

1. Innovative ideas that led to increased agricultural production and diversification,
2. Easy implementation of ideas due to higher personal stakes of members in the outcomes,
3. Self sustaining processes due to emergence of interest/focused group/members who can play greater role in future for disseminating technologies indicating a bottom up process.
4. Increased awareness and sense of urgency to bring improvement in existing water management practices amongst members,
5. Opportunities for increased sources of income,

NEW LEARNING TO PROJECT PARTNERS

Some of the salient learning reflected was;

1. Role and need to involve wider communities in participatory processes,
2. Effective relationships and understanding within the project partners require to move forward effectively.
3. Quality dialogues, communication products in terms of leaflets and strategic participatory field demonstrations can be an effective replacement for subsidies to provide greater sustainability to participatory processes.
4. Emergence of innovative ideas through community involvement in technology identification and development has chances of wider sustainable adoption.
5. Timing of withdrawal of facilitators is a critical decision which needs to be judged properly for sustainability and up scaling of ideas broadcasted in future

CONCLUSION

Peoples' participation has been identified as one of the major principles for sustainable development of water resources. This reflects to believe that people who inhabit an environment over time are more competent to make decisions. Dynamic nature of land and water invites wide range of stakeholders having multiple interests leading to complex integration amongst them. Establishing dialogue amongst these stakeholders needs identification of appropriate processes and means through which they can be brought together for a common goal. The experiences in collaborative project and wide range of project partnership reflects that participation with community members on land and water related issues is mainly focused on two general types of situations a). set of issues focusing immediate and critical concerns leading to short-term emergencies or gains such as; irrigation needs, eradication of seasonal water logging and falling crop yields and b). concerns that provide opportunities to different stakeholders to come together for longer-term, precautionary issues. To achieve these goals the perspective should be broader which may accommodate members from wider constituency.

REFERENCES

1. Anonymous. 2004. Realising Potential: Livelihoods, Poverty and Governance. Workshop proceedings published during the worshop held at NASC campus, New Delhi during 3-4 August 2004.
2. Anonymous. 2002. NATIONAL WATER POLICY. Accessed on internet ***http://www.angelfire.com/bc/nihhrrc/NWP.html*** on 27th January 2006.
3. Joshi, L. K. 1997. Irrigation and its Management in India – Need for Paradigm Shift. Published in the proceedings of Management of Irrigation A New Paradigm, Participatory Irrigation Management. National conference on Participatory Irrigation Management held in New Delhi from 20-22 January, 1997, pp.1-84.
4. Vermilion D.L. and Brewer J.D.1995. Irrigation Specialists, International Irrigation Management Institute, Colombo, Sri Lanka. Participatory action

research to improve irrigation operations: Examples from Indonesia and India. Irrigation Scheduling: From Theory to Practice – Proceedings, Proceedings of the ICID/FAO Workshop on Irrigation Scheduling, Rome, Italy, 12-13 September 1995, ISBN 92-5-103968-2. Accessed on internet ***http://www.fao.org/docrep/W4367E/w4367e00.htm#Contents*** on 11th January 2006.

5. Sikka A. K., Singh A. K., Upadhyaya A., Bhatnagar P. R., Saha B., Singh R. D., Gautam U. S., Palmer Jones P. R and Gaunt J. L., 2004. Theme-2, Practical ways forward for participatory land and water management in canal command. A report presented in the workshop on Realizing Potential: Livelihoods, Poverty, and Governance, 3-4 August, 2004, at NASC, New Delhi.

6. Singh A. K., Sikka A. K., Upadhyaya A. and Bhatnagar P. R. 2005. Exploring Options For Better Use of Water At RPC-V. Bullettin No.: R-14/PAT-5. Published by ICAR Research Complex for Eastern Region, Patna, Bihar, India.

PARTICIPATORY IRRIGATION MANAGEMENT IN THE IRRIGATION NETWORKS OF TEHRAN PROVINCE

Abdolreza Ahmadi, Saeid Rafiyee

1- INTRODUCATION:

Participatory Irrigation Management in the section of irrigation and agriculture in the wide land of Iran with water scarcity has a long history. Such as the Sheikh Bahayee scroll In Esfahan or in the previous Tehran during Saljooghiyan government and first Toghrol had a special supervision on the rivers and typical irrigations, drinking water distribution of the water stores in the city were related to some high social aspects and Water User Associations relevant to the groynes, Prunes, coal-bins and ploughshares have been existed from long time ago.

The people establishments have been created voluntarily or by demands for the purpose of better operation of water resources, land and agricultural products in the majority of areas. They have continued by political and governmental changes until now.

In the years 1961 to 1971, IRAN performance of some land reformations and ownership system changes created small pieces of land with the reduction of objectives of political and economical powers; creation of rural class respects; better system of trade and demand system in the national level; government invested directly in the field of management, water supply & distribution and by governmental subsidies without considering the role of farmers in determination of real prices of water so that farmers right now think that they are entitled to have free water and providence of that is know a duty of government.

After the victory of Islamic revolution of Iran government provided a fast development in water industry in the demand of work in a way that the resource dams which are under operation and use are more than 170 national dams in provinces and about 83 national resource dams are being built, so in this case the number of them has been increased and the irrigation networks have covered lands more than 1609 thousands hectares.

The government of Islamic revolution of Iran for removing some barriers has used of successful participatory irrigation managements from all the global countries of world and this increase has been so effective for the role of people in the matter of building water industries and irrigation network management; reduction of performance time of development designs of water resources have been considered. Speeding in the mode of economical affairs of country and change of participatory management is necessary for construct and sign of water industry which is more than 2100 billion Rials in 4400 thousands hectares from agriculture land that this amount of money has been investigated for it.

Some steps have been taken in all over Iran for the purpose of management changes of irrigation in irrigation networks and soaking and wetting that are related to local farmers and some of these managements are different with each other which most of them are out of order and some of them their usage is so rare.

In many of considerations the shift of participatory management in the world seems, some developed countries and knowledgeable countries that are more aware in the matter of agriculture have used this participatory management such as America, Spain, Philippine so they have been succeeded to improve this matter by providing some rules in special areas and expensive facilities and they have controlled the works for the purpose of better operation also they have provided some new rate of water value, so by this action they have guaranteed the success of their design.

The process of participatory management shift has been done by voluntarily establishment of people or it has been done by the application of government , so they have been able to use this design for being performed. Some other countries that have not provided the environment for this design include Sri Lanka, Senegal, Pakistan and Colombia. In fact these countries have not considered the facilities and the right of water value, but they have set only the design models so that they have been succeeded to use the participatory management shift from other countries, after a short time they have faced with failure.

2- FAMILIARITY WITH IRRIGATION NETWORKS OF TEHRAN PROVINCE OPERATION CO,

Operation company of Tehran province has three irrigation network that include:

1. Varamin irrigation network located in 30 km in the east of Tehran (65 % activity of firm)
2. Karaj irrigation network located in 25 km in the west of Tehran (25 % activity of firm)
3. Hashtgerd irrigation network located in 40 km in the west of Tehran (10 % activity of firm)

This firm uses more than 250 million cubic meters water from dams name Litan, Amirkabir, Jajrood rivers, Damavand and Hashtgerd and 40 pits of Tehran channels that this water will be delivered by more than 13100 farmers so submitting water is according to the capacity submit and after paying the right of water it will be given to the applicants.

In 1994 this firm has been registered and it has started its activity by the objective of providing and distributing right of water which is required to the farmers in the level of seven cities (Varamin, Pakdasht, Karaj, Hashtgerd, Robat Karim, Shahriyar and Ray city).

2-1- Varamin Irrigation Network

In varamin for the purpose of operation from irrigation of Varamin land irrigation network operation with the capacity of 50,000 hectares(that is able to be increased to 80,000 hectares) the irrigation channels have the length of 630 km so the needed water to farmers will be submitted in 150 places.

Length of irrigation networks in Varamin Network	Degree 1(km)	Degree 2(km)	Degree 3(km)	Degree 4(km)
	68	113	200	250

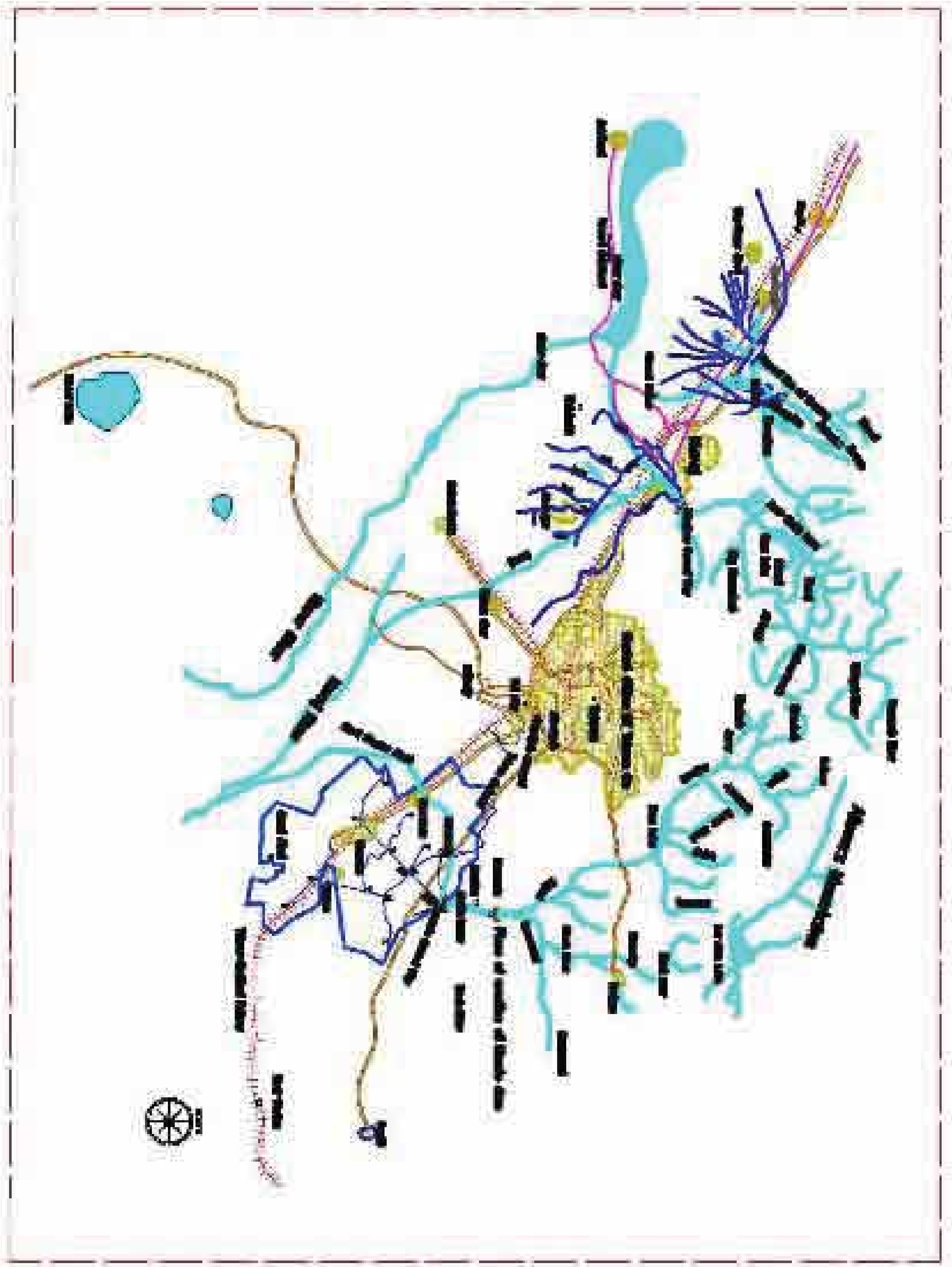
2-2- Karaj Irrigation Network is for the purpose of coverage of 15000 hectares of lands and gardens which is located in the area and by they have been created by the length of 109 kilometers so the needed water to the farmers will be given in 80 places.

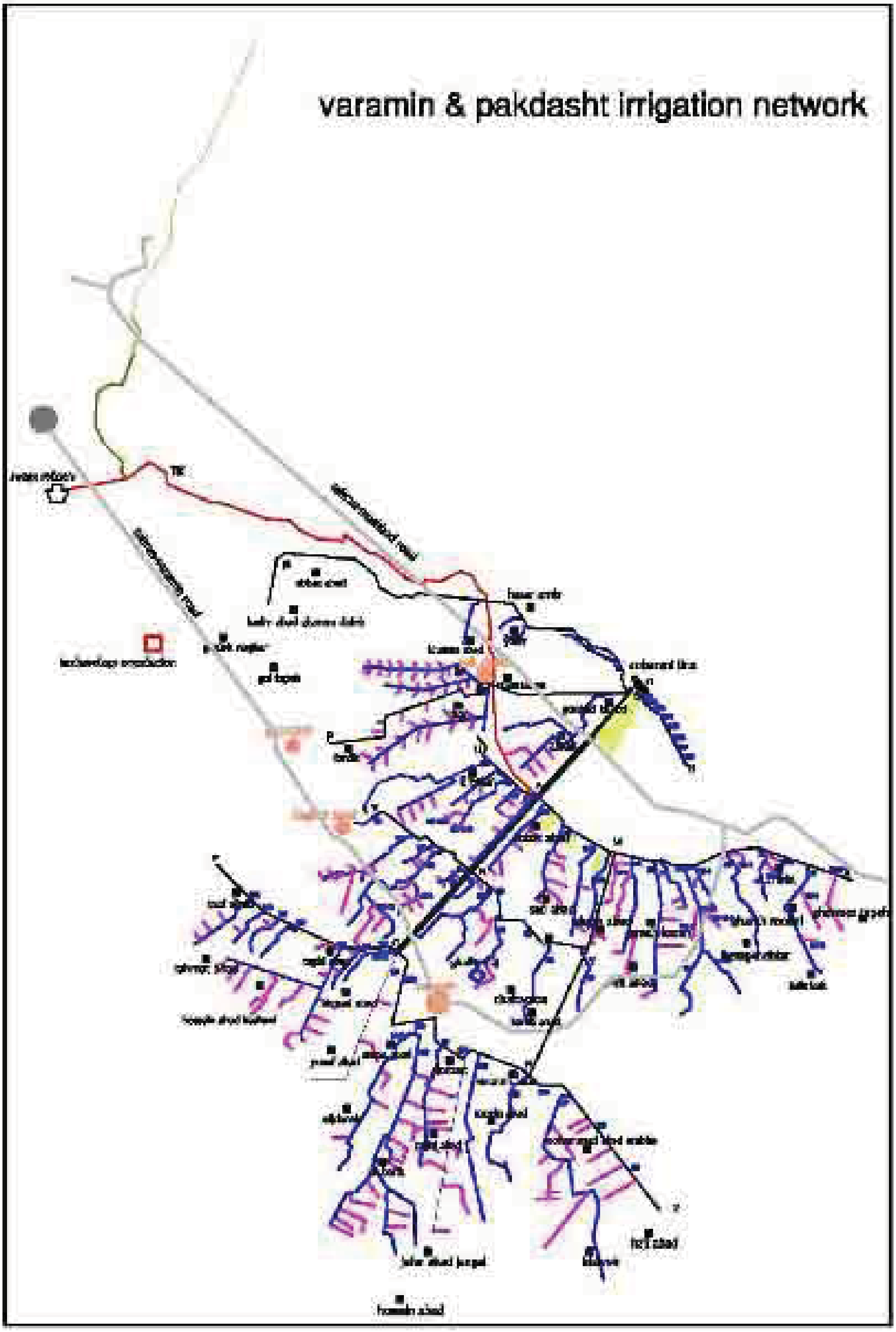
Length of irrigation networks in Karaj Network	Degree 1(km)	Degree 2(km)	Degree 3(km)	Degree 4(km)
	53	41	15	____

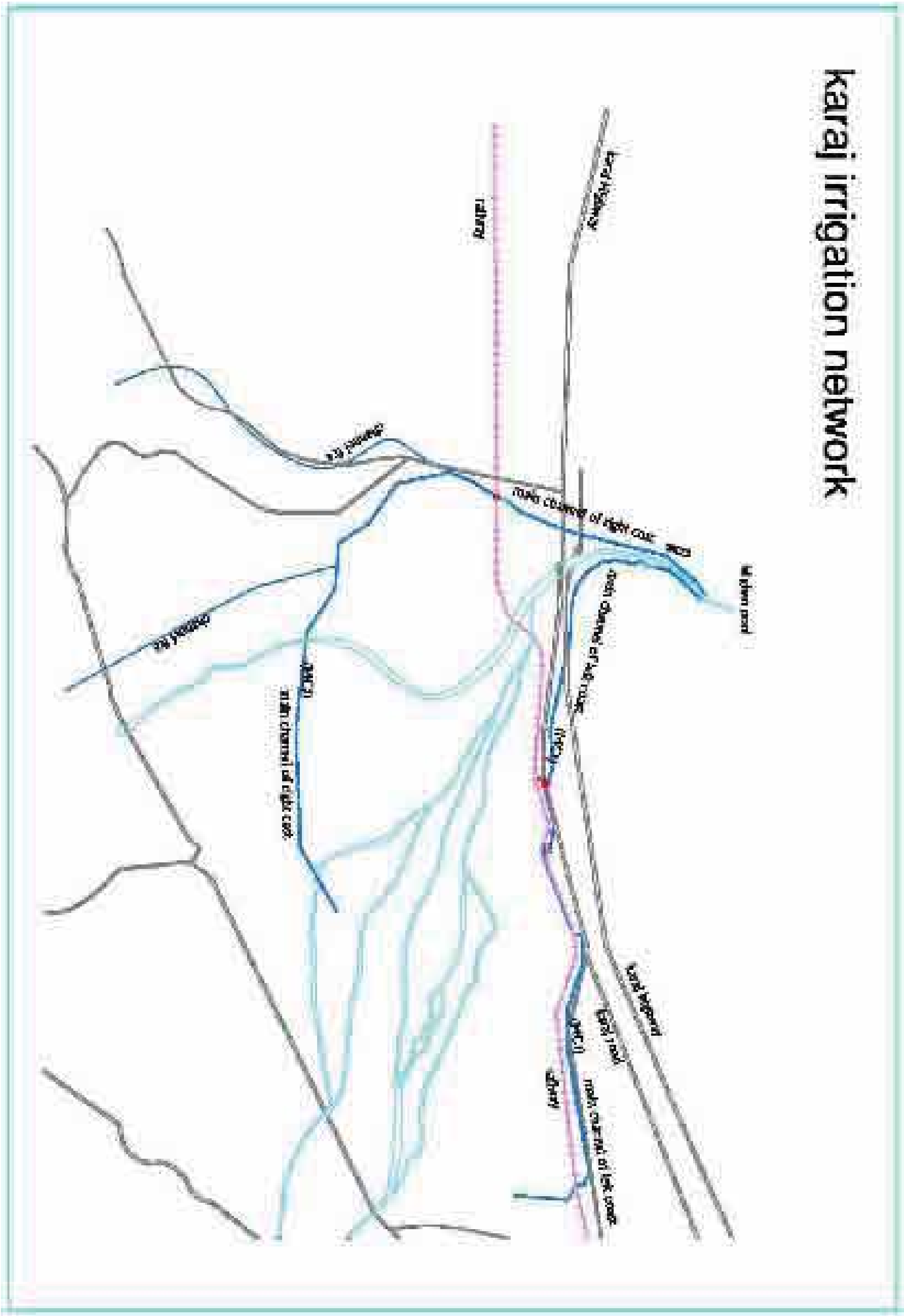
2-3. Hashtgerd Irrigation Network is for the purpose of coverage of 10,000 hectares of lands and gardens with the length of 55 km and the needed water to the farmers will be submitted in 40 places.

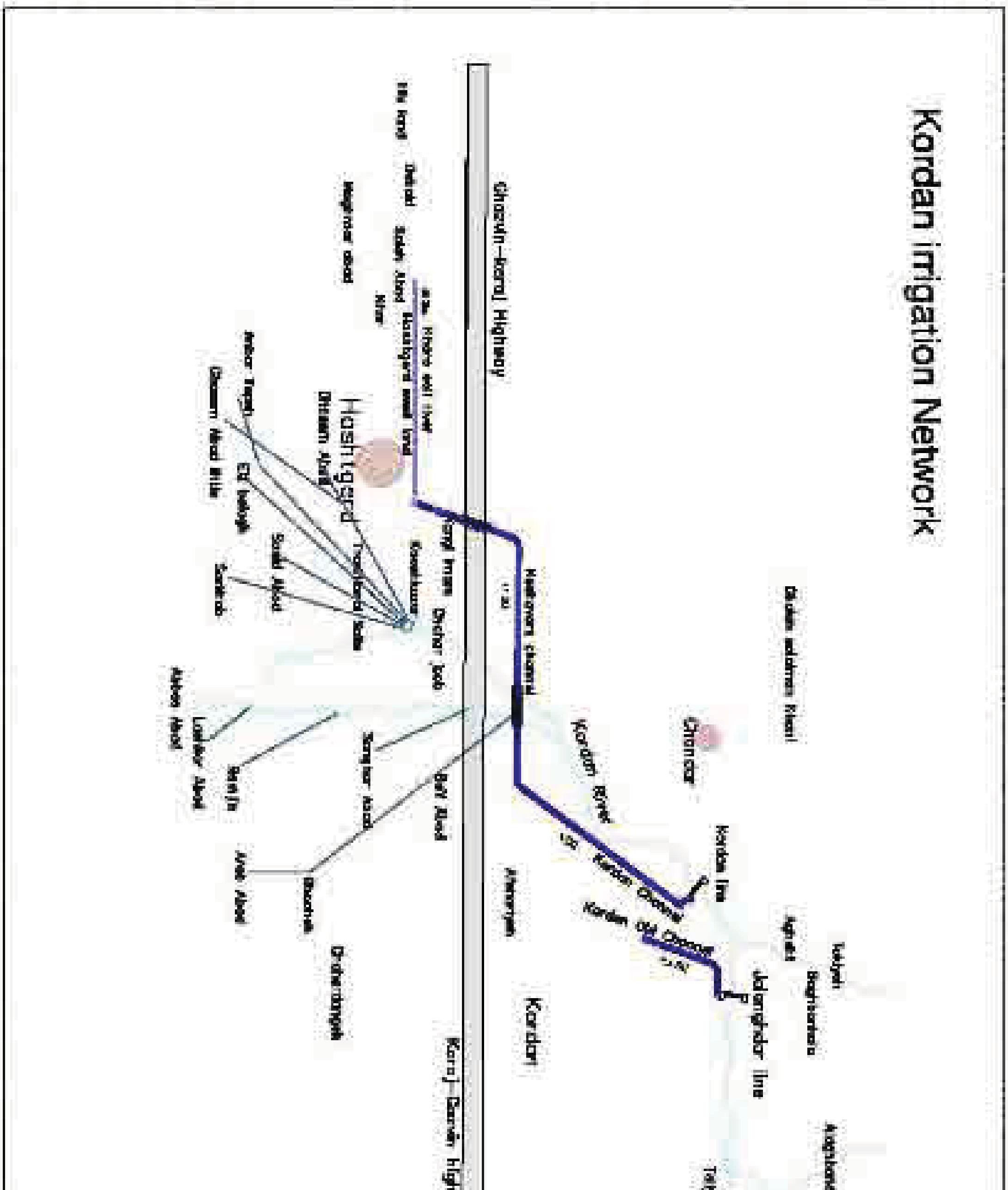
Length of irrigation networks in Hashtgerd Network	Degree 1(km)	Degree 2(km)	Degree 3(km)	Degree 4(km)
	15	25	15	80 (traditional ways)

2-4. Tehran channel (Rei City): Tehran irrigation channel of Varamin has the length of 30 km from Rei city, the canal water and 40 pits of Tehran channels will be sent to Varamin. And after handling and filtering by the amount of 8 m3/s of water will be sent to Varamin.




varamin & pakdasht irrigation network
hossein abad


karaj irrigation network
karaj highway
railway
main channel of right cost.
main channel of left cost.
karaj road


Kordan irrigation Network
Hashtgerd
Kordan
Kordan River
Kordan Channel
Kordan old Channel
Karaj–Gazvin highway

3. POLICY OF TEHRAN PROVINCE OPERATION CO,

In the beginning years the activity of Operation company of Tehran province of the 390 farmers of villages was given directly to the administrations of firm, the applicant had divided them into 380 places according to the gates of submitting water and geographical location, each place would introduce a representative that be confirmed by Islamic council and the ministry of Agriculture construct for the purpose of gathering right of water from farmers and submitting water.

The farmers pay some money for services that water distributors do and in case if the farmers are not satisfied with their representative they will try to make another election for electing another representative for this position.

The above classification caused that the number of referrers be changed from 13100 families to 380 persons, so that some voluntarily establishment were chosen by people for collection right of water that the shift and safety point and distribution of water will be done by that and this matter would be under the satisfaction of all the farmers.

This company has provided some face to face meetings with farmers, consumers of the whole water of network and at the moment about 11 establishments of water have been provided for water and the matter of operation which they have been registered and they are active in the irrigation network managements which are degree 3 and 4. The abovementioned establishment will be done by selection of board of directors and managing director that some manpower will be employed for cleaning the gates and canals and for prevention of water robbery.

The voluntarily establishments of water will be provided in a section that the farmers have a high knowledge for this matter and this firm has concluded that at least about 22 other establishments are needed so that the networks will be controlled separately and independently, for the purpose of this matter Dr. Heidariyan is invited to facilitate and cooperate so that the firm will follow the mode of farmers activities and some considerations and evaluations will be done in this field so that the reasonable solutions on the conditions of each area should be detected and provided.

The counselor of design will perform some meetings with the managers of firm and will evaluate the mode of shifting participatory management which is needed and the following priorities will be determined to irrigation network and so much clear objectives for the purpose of creating new establishments will be provided that include:

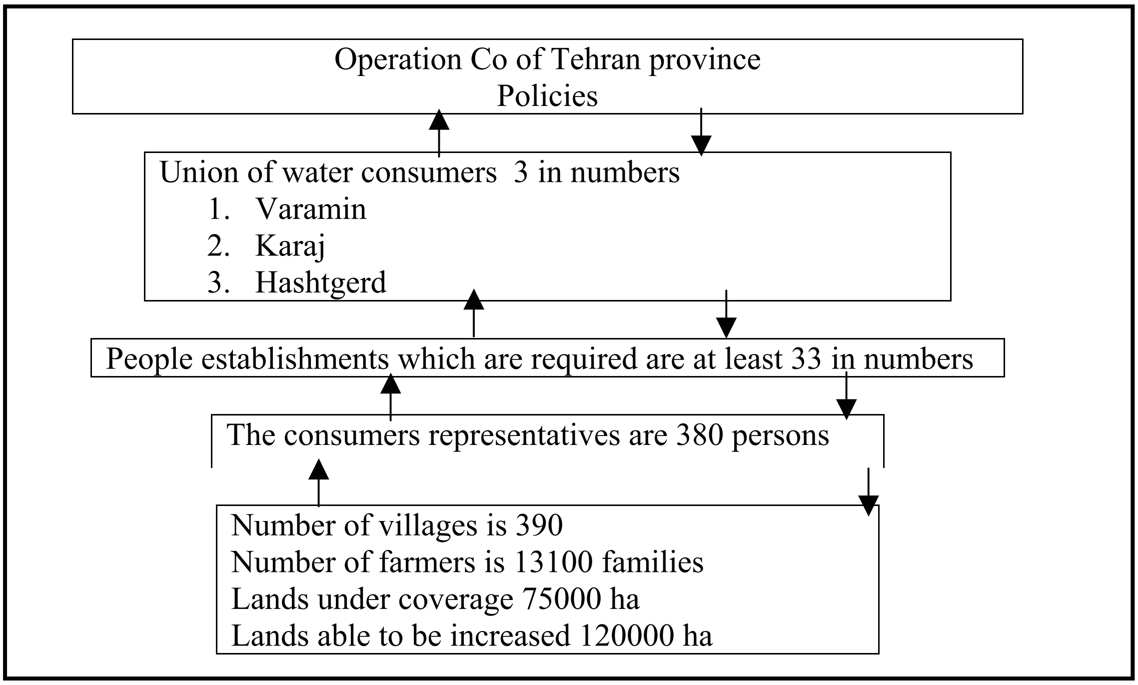
FIRST PRIORITY: AVAILABLE PEOPLE ESTABLISHMENTS WHICH ARE REGISTERED:

- Performance of at least 7 meetings by board of directors and the establishments will be done separately by the objective of reaching to written agreement which is necessary and the shift of participatory management and operation responsibilities and keeping the networks with degree 3 and 4 and their documentations
- Controlling the meetings notes by operation Co until finalization point.
- Providing at least one expert who is interested to this subject in part time or by the firm for the purpose of local management support as a facilitator.

SECOND PRIORITY: ENCOURAGEMENT OF FARMERS FOR THE PURPOSE OF PEOPLE ESTABLISHMENTS VOLUNTARILY:

- Establishment of training workshops by presence of local authorities in the necessary level by the objective of farmers familiarity with advantages and losses of participatory management shift and creation of establishments
- Consideration and adjustment of necessary agreements by participation of establishments and local responsible persons.
- Organizing and registering the establishments
- Documentation of establishments
- Performance of at least 7 meetings by presence of counselor of 12 meetings without counselor for the purpose of strong establishments
- Controlling the notes of meetings with farmers by company
- Providing at least one expert who be interested to this subject and works as part time as a facilitator from firm for he purpose of using of rules and available instructions

After registration and handling at least 33 establishment in the level of their irrigation networks will be acting under the coverage and management of 3 unions in the level of Varamin-Karaj cities and Hashgerd and this matter will have a participatory management in the matter of distribution and maintaining irrigation networks of degree 3 and 4 that are about 600 km and it will be done by supervision and policies of operation firm of Tehran province and in case the successful participatory management shift be able to submit the canals degree 1 and 2.



4. PROBLEMS AND BARRIERS FOR SHIFTING THE CHANGING MANAGEMENT IN TEHRAN PROVINCE

Participatory management shift in each area is related to the local and special conditions of each area and in case no reasonable solution be considered for this matter the success and lasting point of establishments will be faced with some problems or failures.

4-1. SETTING IRRIGATION NETWORKS NEAR CAPITAL CITY

Setting Irrigation Networks near capital city which is Tehran with the population of 8 million persons will make the distribution of agriculture water under the special political conditions such as the priority of providing drinking water of Tehran and Karaj from dams such as Litan and Amir Kabir and the share of agricultural water of dams will be determined and according to the limitation of saved capacity of provided dams which is needed for farmers there is not a certain point in no season and this matter causes that underground waters be used more than legal level and at the moment the falling of 2 meters of underground resources has provided a very great disaster. The farmers are never confident about their applied water and they have an outlook towards the establishments with some doubts and they do not show so much interests in this field.

4-2. SEPARATION OF DESCENDING (SNOW AND RAIN) DURING YEARS

The dried climate conditions and half-dried and average climates with the average of 210 millimeters of water per year is ruled to Tehran province. The majority of rains during winter and spring on the high areas of dams such as Amir Kabir and Litan will be occurred and this matter has caused that the dams be immediately full of water during spring and when the snows are being melted and some floodwaters will be happened till the level of 150 cubic meter per second and from the second month of spring till the mid of autumn the rains and atmospheric descending will not occur and during some dried years such as 1998-2000 no water will be allocated for agriculture and according to the last managements that have been provided for this matter by completing the dam of Martyrs Ghomi(Mamlo) these floodwaters will be saved by two times and from other side after handing the refineries in Tehran their hog-wash will provide a section of farmers water need permanently during year.

4-3. FAILURE OF PAST EXPERIENCES OF FARMERS IN THE MATTER OF ASSISTANCE

The farmers have provided some assistance establishments by encouragement of governments in recent years in the matter of agriculture, but many of these establishments have been cancelled due to some lying promises and such as the equality level of share and vote in elections and some of them have been inactive. According to the unsuccessful experiences which have occurred in the past the encouragement of farmers for providing establishments has been faced with some problems and it has an activity with by two times of previous times.

4-4. THE LACK OF SUPPORTIVE RULES

In the current rules the limitation of authorities and commissions of establishments and legal solutions need a support that it has not been determined and or it won't be performed and this matter will bring a negative point in the mind of farmers.

4-5. RIGHT OF WATER RULES AND DISTRIBUTION OF WATER BASED ON JUSTICE

In the rules that were provided in before creation of irrigation networks the agricultural lands have the right of water and many of down area lands that have been submitted after the years of network creation do not have the right of water. So in this case there is so much arguments between these two groups and at the moment this firm, does not distribute water based on justice and nor on the right of farmers and it distribute water in a way that there is no so much satisfaction of operation and farmers.

4-6. DIFFERENT TACT IN GOVERNORSHIPS POLICIES

The location of irrigation networks in at least 8 governorships face with different tact in the field of activity and local and tribal arguments which will provide some special problems form management shift in the cities of Tehran province.

4-7. LACK OF REASONABLE MODEL EXISTENCE

At the moment there is no a reasonable and successful model for the purpose of attracting people participation in the participatory management section.

4-8. LACK OF NEED FEELINGS BY FARMERS TO AUTO-FUNCTIONAL ESTABLISHMENTS

Until now the establishments have not been provided according to the application of government nor according to the feeling of farmers needs and this matter has caused that farmers have more expectations from government and they believe that government can provide this matter in the demand of work by removing responsibilities and shifting amendment expenditures and keeping to farmers by people participatory management.

4-9. LACK OF DETERMINATION OF RAPID POINT OF ESTABLISHMENTS

According to the necessity and emphasize of people participation the rapid point of establishments is not clear and unfortunately there is not coordination between Agriculture Jihad Ministry and Power Ministry and some other administrations.

4-10. REAL VALUE OF WATER

Determining the level of water value has been done from long time ago and it would be supported such as a demand of work of governmental loss and the farmers still expect to have free water from government.

4-11. FAST GROWTH OF HOUSING TISSUE

The fast growth of housing tissue around Tehran and added value of farmers in case if be changed to housing, industrial and trade causes that farmers to give up the lands which are located around Tehran and to earn some advantages and they face with the matter of establishments in a very superficial way.

4-12. LACK OF DETERMINATION OF FACILITIES, ENCOURAGEMENT AND CHANNEL DAMAGES LEVEL

The level of providing facilities and financial encouragements and or developmental supports in the matter of keeping and operating has not been considered and according to the damage point of canals such as Karaj with more than 40 years, the farmers see themselves against expensive expenditures of amendments and keeping and with not encouraging support and they do not show any encouragement for providing establishments themselves.

4-13. SAFE-POINT AND PAYING LOSS MULCT

Due to fast growth of cities and the increase of vehicles falls and people and human losses and financial losses in the canals and according to the compulsive point of paying loss mulct to the persons who have been left and or the high expenditures of hand-railing and safety point around the channels, the farmers ignore accepting the channels management.

REFERENCE:

1. Consumer establishments- past- Present- Future- Jawad Khorshidi Far, the fourth technical workshop of farmer’s participatory in irrigation network management, December 22 ,2005(Spain, Tomar Sheikh Bahayee, America(Colombia Basin); Mexico; Sri Lanka; Philippine)
2. Record and current situation of consumer establishments of water and scientific analysis of legal establishments creation in irrigation network of Ghazvin(Ahmad Pour Zand)
3. Land amendments and economical economic of Iran, Gozideh library, Tehran the center of scientific documents, 1972 (Mirzadeh Pour Zand)
4. The crisis of irrigation management shift to the operators, 2003 (Seyed Mojtaba Naboy)
5. Management Shift, methods and barriers and solutions, 2003 (Seyed Ahmad Heidariyan and cooperators)
6. The collection of articles for the fourth national conference of farmers participation in irrigation & wetting network management (methods and basis) (management of water resources), January 2005
7. The first technical workshop for farmer's participation in irrigation networks management (Ahamad Pour Zand), November 1999.

IS PARTICIPATORY GROUNDWATER MANAGEMENT AN OPTION?

Jaime D. Hoogesteger van Dijk and Linden Vincent[1]

ABSTRACT

In Iran as well as in the rest of the world, a large sector of the irrigated area is totally or partly dependent on groundwater. As such groundwater has become a cornerstone of many regional economies and societies. Yet contrary to surface water irrigation, where a lot of attention has been given to PIM, within the groundwater irrigation sector there has been very little attention for participatory management of groundwater resources even though in most places it is a very pressing issue. Dropping groundwater tables and pumps that run dry in many areas clearly show that often the present use of groundwater is unsustainable. In irrigation systems where conjunctive water management takes place combining groundwater and surface water management can offer an option for participatory groundwater management. This case study analyzes the situation of groundwater resource use in the Abshar irrigation system in the Zayandeh Rud Basin Iran and establishes the question if participatory management of groundwater and conjunctive use is a viable option for irrigation management in the present context.

GROUNDWATER USE IN THE ZAYANDEH RUD BASIN

The Zayandeh Rud basin is situated in the centre of Iran and covers an area of 41,500 km^2. The basin originates in the Zagros Mountains at altitudes of around 2300 m, where rainfall and snow are abundant[2], and closes in the Gavkhuni swamp at an altitude of 1466 m. The majority of the basin is a typical arid and semi-arid desert. The city of Esfahan, with almost two million inhabitants, and its fertile plains[3], form the main socio-economic area of the basin. Esfahan lies at an altitude of around 1800 m and has an average annual precipitation of 130 mm, concentrated in the November-April period. Temperatures are hot in the summer, reaching an average of 30^{o}C in July, but are cool in the winter dropping to an average minimum temperature of 3^{o}C in January. Annual potential evapo-transpiration is 1500 mm (Molle *et al.,* 2004).

1- Jaime D. Hoogesteger van Dijk (MSc) is presently Junior Researcher and Lecturer at the Irrigation and Water Engineering Group at Wageningen University in the Netherlands- E-mail: Jaime.hoogesteger@wur.nl
Professor Linden Vincent is presently professor of the Irrigation and Water Engineering Group at Wageningen University in the Netherlands. E-mail: Linden.vincent@wur.nl
Address: Irrigation and Water Engineering, P.O. Box 47, 6700 AA Wageningen
T: +31 317 48 41 90 F: +31 317 48 47 59

2- In the head of the basin at high altitudes precipitation averages at around 1700 mm a year.

3- The fertile plains are constituted by alluvial deposits flanking the Zayandeh Rud where slopes are gentle and soils have good soil moisture holding capacities (Salemi *et al.,* 2000).

In the lower and dryer parts of the basin, irrigation is a must for agricultural production. For centuries, water from the Zayandeh Rud River has been diverted to supply the city of Esfahan with water and to irrigate its gardens and neighboring areas. The peak flows from April to June provided the basis for widespread downstream irrigation using simple diversion structures, called *mahdis*, to make productive use of floodwaters (Salemi *et al.,* 2000). Beside surface water, most downstream areas have groundwater supplies close to the surface. The recharge of these is mostly direct recharge from the Zayandeh Rud River (idem, 2000).

Beside surface water, groundwater is one of the most reliable water sources in the Zayandeh Rud Basin. In the basin twenty unconfined and two confined aquifers have been identified. Presently about 21,200 tube wells, 1,726 qanats and 1,613 springs exploit a total of 3,619 MCM of groundwater a year. Studies conducted by the Esfahan Water Authority (EWA) in 2000 reveal that several aquifers are being over-exploited especially in some of the irrigated areas (Morid, 2004).

On basin level, 72% of total water use is groundwater with a total estimated use of 3500 MCM per year. The bulk of this water is used for agricultural production. In the irrigation districts groundwater use is high. In Nekuoabad and the areas of the Abshar and Rudasht irrigation districts that are near the Zayandeh Rud River have shallow aquifers of between 10-50 m. that are intensively exploited for agriculture. In these shallow aquifers there is a direct link between river flows, surface water irrigation in the systems and the level of the groundwater table (pers. com. Saberi). In general it is observed that the further form the river bed, the deeper the aquifers. These deeper aquifers respond much less to the fluctuations of surface water flows in the river and can be considered mainly as fossil water reserves (*idem*). The deep aquifer water reserves are used mostly in the Brokhar and Mahyar irrigation systems as well as the northern most edges of the Abshar Left Bank.

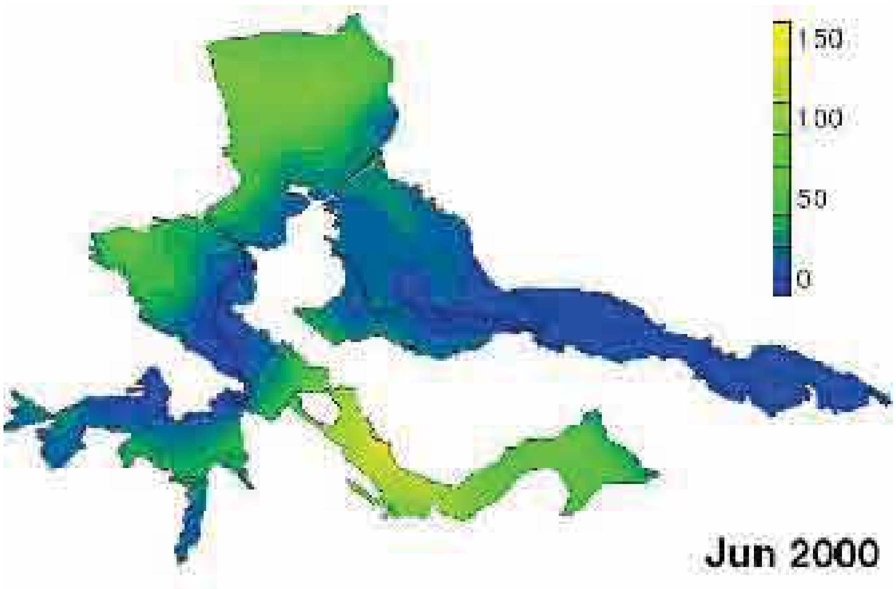


Figure 1: Groundwater levels in the main irrigation systems of the Zayandeh Rud basin in June 2000 (Droogers and Miranzadeh, 2000)

During the years of drought the shallow aquifers in the irrigation systems had a severe drop in groundwater levels as groundwater use increased while recharge was almost absent. Several farmers responded by deepening the existing wells. According to Saberi (pers. comm. and confirmed by farmers' interviews) the drop of groundwater levels in the deep aquifers also increased during the drought although in these deeper aquifers the drop of water level was less severe than in the shallow ones.

Groundwater resources are being overexploited in several areas of the basin with the associated water quality degradation (Salemi, 2003). This means that on the long run the exploitation of deep aquifers that have little direct recharge form surface water resources will exhaust the groundwater reserves. As control over groundwater, especially on the use of shallow aquifers, is very hard due to the fact that installing a shallow well is very easy, the EWA is limited in its management of groundwater to monitoring groundwater levels and limiting the construction of new deep wells.

GROUNDWATER USE IN THE ABSHAR IRRIGATION SYSTEM

In the Abshar system groundwater is, beside surface water, the most important and reliable source of water for irrigation. Most of the wells are owned individually or managed by a small group of farmers compromised by 2-15 users. Historically a couple of areas that lie within the irrigation system relied on qanats for their irrigation water. At present because of the large amount of tube wells, all qanats in the area have fallen dry, being replaced by either surface water irrigation or the use of wells (Hoogesteger van Dijk, 2005).

Groundwater management knows different forms of management but generally these are confined to a limited group of users in the field. The most common modes of groundwater management are:

- *Private well for private use*: This mode implies little organizational control as it is one user that has control over the water flows. In some cases the users use the surface water canals for transporting the water. In these cases it is only necessary to ensure that the use of these does not affect other users.
- *Private well for private use, selling excess water:* In some cases when farmers have a well, which exceeds their personal needs, they sell water to other users. In this case farmers have to organize to manage the water. In such cases, because of the high number of users, groundwater gets managed under the same rules as surface water. The only difference there is that the fees for the use of the water go to the owner of the well instead of the Mirhab. The fact that the well owner is also the outlet tender makes the management and regulation easy.
- *Private well owned by several users:* Often farmers do not have enough resources to invest in a well by themselves. In these cases, farmers often organize in groups of two to five users, mostly friends and family and jointly invest in the drilling and installation of a well. The most common arrangement for these wells is that farmers pay for the O&M of the well according to the amount of hours they make use of it. As in most cases it is friends and family that jointly invest in a well.

THE NEED FOR GROUNDWATER MANAGEMENT

In view of these developments there is a pressing need for groundwater management. Governmental control seems very difficult all around the world because of:

- The individualized character of groundwater technology (individual pumps) coupled to easy access to it and low use requirements. This makes it very hard for institutions to control the development and use of groundwater in areas where groundwater is readily available in economically exploitable aquifers. Users operate independently and are therefore hard to control.
- An institutional history based on the development and not the control of groundwater: throughout the twentieth century most water management institutions either promoted the development of groundwater use as a way to promote economic development and alleviate poverty, or left it to an uncontrolled lassie-faire development. Because of this there is neither a groundwater management culture nor control over the use and exploitation of this resource.
- A lack of funds and resources to implement a strict control on pumping: this is coupled mainly to the history of the institutions which have historically spent most of their resources and personnel on water development; the construction of infrastructural surface water management projects, subsidies for groundwater development and their management. Groundwater management has up until now not been a major priority of water management authorities.
- The social implications of restricting groundwater use. A great part of the agricultural production has become dependent on groundwater utilization. Restricting the use of groundwater has great impact on this agricultural sector and the livelihoods that depend upon it.

In view of this absence of governmental control and the importance of groundwater in the local economies and the increasing perception that users should become the managers of their resources participatory groundwater management has been seen in some places in the world as the key to the groundwater management problem. Mexico has for almost a decade promoted different projects that are based on participatory groundwater management with mixed results (Wester ,*et al.,* 1999; Marañon-Pimentel, 2000a, 2000b; , Hoogesteger-van Dijk, 2004).

Participatory groundwater management has proven to be a challenge, which has many hurdles on the way but some experiences show that with collective action for groundwater management it is possible to reach better groundwater management. Some of the key issues in such processes are: user awareness of the problem, its consequences and available management strategies; commitment on the part of the users; visible results for the users; strong collective commitment to work together on the management of groundwater. Whether these elements come together or not depends a lot on the boundaries of the institutions for groundwater management, the characteristics of the aquifers and the social and institutional structures existing in place.

IS CONJUNTIVE WATER MANAGEMENT FEASIBLE IN SURFACE IRRIGATION SYSTEMS?

Surface water irrigation systems, through their infrastructure usually create social relations of dependence needed to manage the system and get water from the sources, in this case the Zayandeh River to the fields. At primary and secondary system water management is agency managed until now. At tertiary level, water management becomes the responsibility of the users. These organize to manage the water based on long established customs and rules of water, labor and responsibility division. These systems have proven to be very effective in the management of water.

A question that arises here is whether these social structures could be used for the management of groundwater resources. There are no clear cut answers to this, but conjunctive water management could be a very feasible option for water management. In California some modeling experiences show that conjunctive water management can enhance an economically more viable resource management (Harou and Lund, 2006) especially where the surface-groundwater links are very strong and visible such as in the Abshar irrigation system. Of course here the challenge remains being how can it be implemented. Should there be a top down approach in which the state regulates and dictates, or should the effort and insights come from the water users, or should both work together? If so how should such a management system be crafted?

This paper does not want to give answers or guidelines, it rather wants to trigger the thought on whether through participatory groundwater (or conjunctive water) management it is possible to establish control measures for groundwater management in a case such as the Abshar Irrigation System or any other area where groundwater exploitation levels form a threat for the sustainable use of groundwater. So the first question to be established is:

Is participatory groundwater management within and outside of surface water irrigation systems a feasible solution?

If so....

- What knowledge is needed?
- What social structures are needed and at what scale?
- How should responsibilities be established and who should be responsible for what?
    - o What role should be delegated to the state?
    - o What role should be delegated to the water management agencies?
    - o What responsibilities should go to user organizations and how do you organize these?
- Is there a need for institutional engineering?

BIBLIOGRAPHY

1. Droogers P., Miranzadeh M. 2001. *Spatial analysis of groundwater trends: example for Zayandeh Rud Basin, Iran.* IAERI-IWMI, Iran.
2. Harou J., and Lund J., 2006. *Economic and water management effects of a no overdraft policy: California's Tulare Basin.* Paper presented at the International Symposium on Groundwater Sustainability (ISGWAS), January 24-27, 2006, University of Alicante, Spain.
3. Hoogesteger van Dijk J.D., 2004. "*The Underground" Understanding the failure of institutional responses to reduce groundwater exploitation in Guanajuato.* MSc Thesis Irrigation and Water Engineering, Wageningen University, Wageningen, NL.
4. Hoogesteger van Dijk, J.D. 2005. *"Making do with what we have" Understanding drought management strategies and their effect in the Zayandeh Rud Basin, Iran.* MSc Thesis Irrigation and Water Engineering, Wageningen University, Wageningen, NL.
5. Marañon-Pimentel B., 2000a. *Las fuerzas impulsoras del abatimiento de agua subteránea en El Bajío.* In Transformación productiva en la gran irrigación en El Bajío, Cuaderno de Investigación No. 3, IMTA, Mexico.
6. Marañon-Pimentel B., 2000b. *La viablilidad de la organización de usuarios para el manejo del agua subterránea en la Cuenca Lerma Chapala, México.* In Comités Técnicos de Aguas Subterráneas: organización, desarrollo y problemática, Cuaderno de investigación No. 2, IMTA, Mexico.
7. Molle F., Mamanpoush A., Miranzadeh M., 2004. Robbing Yadullah's water to irrigate Saeid's garden: Hydrology and water rights in a village of Central Iran. IWMI Research Report No. 80..
8. Morid S., 2004. *Adaptation to climate change to enhance food security and environmental quality; Zayandeh Rub Basin, Iran.* College of Agriculture, Tarbiat Modarres University, Teheran, Iran.
9. Salemi H.R., Mamanpoush A., Miranzadeh M., Akbari M., Torabi M., Toomanian N., Murray-Rust H., Droogers P., Sally H., Gieske A. 2000. *Water Management for Sustainable Irrigated Agriculture in the Zayandeh Rud Basin, Esfahan Province, Iran.* IWMI-IAERI, Iran.
10. Salemi H.R., 2003. *Irrigation water management in Esfahan, the case of Borkhar region*. Unpublished MSc thesis, Department of Geography, University of Esfahan, Iran.
11. Wester P., Marañón-Pimentel B. & Scott C., 1999. *Institutional Responses to Groundwater Depletion: The Aquifer Management Councils in the State of Guanajuato, Mexico.* Paper presented at the International Symposium on Integral Water Management in Agriculture, Gomez-Palacio, México. IWMI, Mexico.

FARMERS' PARTICIPATION IN IRRIGATION WATER MANAGEMENT IN NORTHEAST IRAN

Ali Asghar Shahroudi[1] and Mohammad Chizari[2]

ABSTRACT

The purpose of the present study was to investigate the farmers' participation in irrigation networks management with an approach to compare two groups of farmers in the irrigation networks with Water Users' Cooperative (WUC) and without it. The methodological approach was a descriptive-correlational and causal-comparative study of the survey type. The target population in the study consisted of 2551 farmers of irrigation networks in Razavi Khorasan Province, Iran. By using stratified random sampling technique, 335 participants were chosen. Data were collected through a questionnaire and were analyzed using SPSS, V. 13. Content and face validity of the instrument obtained by the faculty members of Agricultural Extension and Education, Agronomy and Irrigation Departments at Tarbiat Modarres University and also Specialists Board of Agricultural Jihad Organization and Regional Water Joint-stock Company in Razavi Khorasan Province. The reliability analysis was conducted and Cronbach's alpha values for the various sections of instrument were estimated to be between 0.73 and 0.86. The results of t-test with independent samples showed that there were significant differences in relation to the averages of the variables of status of farmers' participation in irrigation management, annual income, farmers' perception of rural irrigation status, social solidarity, social participation, farmers' attitude toward the WUC, extension contacts, social confidence, farmers' behavior regarding farm water management, their age, experience in agriculture, communication channels and education level between two groups of water users, i.e. those who were in irrigation network with WUC and those who did not, which the magnitude of statistical differences were arranged for these variables, respectively.

Keywords: Participatory irrigation management, water users' cooperative, farmer, farm water management, sustainability

---

1- Graduate Student (M.Sc.) of Agricultural Extension and Education Department, College of Agriculture, Tarbiat Modarres University, Tehran, Iran. Tel.: 011 (9821) 66906555, Corresponding author's e. mail: Shahroudi83@yahoo.com

2- Professor of Agricultural Extension and Education Department, College of Agriculture, Tarbiat Modarres University, Tehran, Iran. P.O.Box: 4155-4838, Fax: 011 (9821) 88006544, Presenting authors' e. mail: Mchizari@modares.ac.ir

INTRUDUCTION

Irrigation has played and will continue to play an important role in the provision of the food supply for the rapidly expanding population of the world (Wijayaratna, 2004). In this connection, water resources limitation is one of the most serious problems in Middle Eastern countries, especially in arid and semi-arid countries (Skaggs *et al.*, 2006). This dazzling benefit encouraged many countries, especially developing countries, to create more and more irrigation facilities. The results of those irrigation development projects did not achieve 100% success, as most of them were managed by the government where farmers' participation was ignored. During the 1980s and early 1990s, government responsible officials started to realize the significance of farmers' participation in the management of irrigation systems from the stand point of sharing the costs and contributing to maintenance. This kind of concept was adopted by many countries as a "Participatory Irrigation Management (PIM)". The purpose of PIM was to involve farmers in irrigation management including operation and maintenance. The merits of PIM are decrease in wasteful use of water, enhanced durability of irrigation facilities, reduction of government burden, facilitation of cost recovery and equitable water delivery. Some countries, such as Turkey and Mexico, have made success in establishing PIM-based projects, while other countries, especially monsoon-Asian countries, are yet to achieve their goal (Tanaka and Sato, 2005).

Water scarcity is the most limiting factor in agricultural productivity in Iran. Considering that about 90% of the country is climatologically arid and semi-arid, the fresh water resources are limited. Iran is an area of 165 million hectares (Mha). The average amount of precipitation over the country is 252 mm/ year or 413 billion cubic meters (bcm), which are less than one-third of worldwide average precipitation (831mm). Based on the studies performed by United Nations (UN) and also International Water Management Institute (IWMI) experts, the per capita water resources of Iran are projected to be about 726-860 m^3 in 2025, compared with 2200 m^3 in 1990 (Ehsani and Khaledi, 2003).

Unfortunately, the lack of proper management, operation, maintenance, system efficiency, and illegal extraction in the irrigation system have remained major problems since the existence of the irrigation network that have resulted in inequitable and unreliable distribution, thus the poor tail-enders are always faced with the shortage of water. In addition, because of low irrigation efficiency, about 50 to 60 percent of the renewable water is lost in agriculture, and this has led to agricultural water productivity (ratio of yield per unit of water) a very low. Therefore, the economic value per cubic meter is 0.75 kg/ m^3 (Keshavarz et al., 2005).

A clear incentive for self-organization among tail and head enders in an irrigation system was found by Ostrom and Gardner (1993). Statistical evidence on data from Nepal supports that self-organized irrigation systems work better than those which are organized by the government. However, success in self-organized groups came about after a struggle. Initially, self-organization led to conflicts and confusion, but when the initiative to self-organization was accepted by some villagers, other villagers followed as well. This ultimately led to a management system for the whole irrigation canal.

WUAs can play an important role in assisting users to adopt new techniques and technologies for more efficient water use and increased production (Smith and Munoz, 2002). In investigations of studies identified that WUAs could been improved (1) Human capital: education, knowledge/ understanding, skills (agricultural, technical, organizational, financial), labour/ time; (2) Social capital: values and norms, organization, power; (3) Physical capital: access to infrastructure, standards of maintenance, appropriateness of design; (4) Natural capital: access to water and land, protection of resources; and (5) Financial capital: income from employment, other economic activities, ability to contribute resources for management and maintenance (Howarth *et al*., 2002).

Transfer of irrigation management responsibilities from government agencies to farmers is now an important policy in a large number of countries (Howarth et al., 2002). In the agricultural sector of Kazakstan's current conditions, there are also clearly identifiable benefits for governmental agencies from the formation of Water Users' Associations including: (1) WUAs provide a single point of contact for negotiations, contracts, and dispute resolution between water users and local water management authorities, thereby significantly easing the latter's increased administrative burden caused by the break-up of the Soviet farm system; (2) WUAs can ease the introduction of water pricing which is at present complicated by the lack of measuring devices for water deliveries to individual farmers. Water deliveries could be measured at the point of delivery to the WUA, which would then handle deliveries to and fee-collection from its members, based on an individual's irrigated acreage, for instance; and (3) Strong WUA can in the future be made the owners of existing irrigation and drainage systems, which the government authorities are no longer able to manage and maintain (Burger, 1998).

To sum up, the farmers' role in development is crucial in enhancing water use efficiency. The creation of new management mechanisms, which give more responsibility and more incentives to farmers to improve the condition of water systems and to economize the use of irrigation water, is an important step (Burger, 1998). Therefore, The most common and effective tool to encourage Water Users (WUs) organized participation, which is used in several countries of the world is the formation of WUCs. The overall aim of this study was to examine and analyze the farmers' participation in irrigation networks management with an approach to compare of two groups of farmers in irrigation networks with WUC and without it. To achieve this purpose, this survey research was performed with the following specific objectives: (1) determination of the professional and individual characteristics; (2) assessment the level of water users' involvement in WUC and non-WUC participatory systems; and (3) comparison of two groups of farmers in relation to the professional and individual characteristics (those who were in participatory system with WUC and without WUA, viceversa).

MATERIALS AND METHODS

This study used descriptive-correlative and causal-comparative survey methodology to investigate the farmers' participation in irrigation networks management with an approach to compare two groups of farmers in irrigation networks with WUC and without it. The methodological approach was a descriptive-correlational and causal-comparative study of the survey type. The target population for the study consisted of 2551 farmers of irrigation networks during the 2005-2006 that conducted in three irrigation networks of Razavi Khorasan Province at villages level, including: “Shahid Yaghubi” Dam of Torbat-Heydarieh with WUC and “Shahid Karde” and “Trogh” Dams of Mashhad without WUC. Through stratified random sampling technique, a group of 335 participants of irrigation networks (166 farmers for participatory system with WUC and 214 farmers for participatory systems without WUC) was selected as the sample out of the above-mentioned population using the method of Krejcie and Morgan (1970) for the determination of sample size. A questionnaire was prepared to gather the data needed for this study. The questionnaire consisted of four parts: part one of the questionnaire was relation to the information about individual characteristics of WUs, including: age, education level, experience in agriculture, distance from farm to agricultural services center. Part two of the instrument was designed to gather data on technical characteristics of WUs, including: farmers’ behavior regarding farm water management and farmers’ perception of rural irrigation status. Part three of the instrument was designed to gather data on the socio-cultural characteristics of the WUs, including: extension contacts, communication channels, social confidence, social solidarity, social participation, farmers’ attitude toward the WUC, and farmers’ participation status concerning irrigation networks management. In this part of the questionnaire, items consisted of five-point likert type scale with responses ranging from zero to 4. Also, the information about economic characteristics of WUs was considered in the third part of the instrument, including: annual income and size of the irrigated cultivation. Data were collected through a questionnaire and were analyzed using SPSS, V.13. Content and face validity of the instrument were obtained by the faculty members of Agricultural Extension and Education, Agronomy and Irrigation Departments at Tarbiat Modarres University and also by the Specialists Board of Agricultural Jihad Organization and Regional Water Joint-stock Company in Razavi Khorasan Province. To assess the reliability of the instrument, a pilot test (N= 30) was performed, and Cronbach’s alpha coefficients were computed for each part and were found in a range from 0.73 to 0.86.

RESULTS AND DISCASION

Objectives 1: The first objective of this study was to describe the characteristics of farmers. The findings of this part showed that 18.4% of the farmers were of an age below 30 years. Those that fell within the age of 30 to 49 years accounted for 46.4%, about 19.5% of the respondents were of the age between 50 to 59 years, while about 15.7% of the respondents were 60 years old or even elder. The findings of this part showed that the age of respondents ranged from 21 to 80 years with a mean age of 45.23 years (SD = 13.8). It was also evident that 23.6% of the farmers had not taken part in any formal education. About 37.6% of the respondents attended primary school, 20.6% had attended secondary school education, about 11.8% of the respondent had high school diploma and the remaining 6.4% attended post-secondary school. The mean of the size of the irrigated cultivation by farmers was 3.45 ha; the minimum and maximum land areas were 0.5 and 15 ha, respectively. Farmers were asked to indicate the number of years they have experienced working on farm. Years of farm experience ranged farm 3 to 65 years (M= 25.26; SD= 13.9). The average distance from the farm to agricultural service center was 5.44 Km. Farmers’ annual income ranged from 7 to 90 million rials (M= 3.15; SD= 1.59) (Table 1).

Table 1. Professional and individual characteristics of WUs.

Variables	Mean	S.D.	Max.	Min.
Age (year)	45.64	13.98	22	82
Education level (year)	4.37	3.78	0	14
Experience in agriculture (year)	25.26	13.90	3	65
Size of the irrigated cultivation (ha)	3.45	2.18	0.5	15
Distance from farm to agricultural services center (km)	5.44	2.73	1	11
Annual income (million Rials*)	3.15	1.59	0.7	9

* 8000 Rials= 1USD.

As shown in Table 2, social characteristics of WUs were categorized three levels including: low, medium and high. The usage level of extension contacts was low (50.9%; n= 168) with an overall mean score of 9.00 (SD= 5.08). The usage level of communication channels by WUs in drainage and irrigation networks was medium (52.1%; n= 172) with an overall mean score of 20.97 (SD= 9.35). Also, social capital components among WUs were evident within the confidence (mean= 12.09), solidarity (mean= 12.27) and participation (mean= 17.49) that each of they were assessed at medium level (Table 2).

Table 2. Socio-cultural characteristics of WUs.

Variable	Low	Medium	High	Mean	S.D.	Min.	Max.	Range
	Percent of respondent							
Social confidence	28.8	45.5	25.8	12.09	5.87	1	24	0-24
Social solidarity	26.7	48.8	24.5	12.27	5.54	2	24	0-24
Social participation	28.5	49.1	22.4	17.45	7.96	3	34	0-36
Extension contacts	50.9	39.7	9.4	9.00	5.08	1	23	0-24
Communication channels	27.3	52.1	20.6	20.97	9.35	5	41	0-44

Objective 2: In order to assess the rate of WUs' involvement in irrigation networks management, 9-item with summated likert-type format was designed in different stages of planning, decision-making, implementation, operation, maintenance and evaluation in relation to irrigation water management so that they could expresses their level of participation by selecting the options. The findings of Table 2 indicates that the respondents' participation levels in irrigation networks with WUC was medium with an overall mean score of 19.92 (S.D. = 6.7). But the level of WUs' participation in irrigation networks without WUC was low with an overall mean score of 12.72 (S.D. = 6.6). In general, it was evident that the status of WUs' participant in participatory system of WUC was better than those who were not in cooperative. Nevertheless, the respondents of irrigation networks with WUC were reported that they have a better

status from the view point of in-farm and on-farm water management, solution of irrigation problems, cooperation with other farmers and irrigation experts, the prevention of water losses, rehabilitation and reconstruction of canals, giving the water rights for improvement of operation and maintenance of networks and programming the water business than those who were in irrigation system without WUC.

Table 3. Status of WUs' participation regarding irrigation networks management

Network type		Very low	low	medium	high	Very high	Mean	S.D.	Min.	Max.
WUC	*f*	2	31	69	37	19	19.92	6.7	5	35
	%	1.3	19.6	43.7	23.4	12				
Non-WUC	*f*	47	61	45	16	3	12.72	6.6	3	30
	%	27.3	35.5	26.3	9.3	1.7				
Overall	*f*	49	92	114	53	22	16.16	7.5	3	35
	%	14.8	27.9	34.5	16.1	6.7				

Objective 3: A t-test with independent-samples was conducted to evaluate the differences between two groups of water users of irrigation networks with WUC and without it. As shown in Table 3, statistically significant differences were found among the individual characteristics investigated in the present study between two groups of WUs, i.e. those who were in irrigation network with WUC and those in non-WUC irrigation networks, with respect to the variables of age, education level, and experience in agriculture, excluding distance from farm to agricultural services center. Among the economic characteristics, there was a significant difference (at a 0.05 level) between two groups of respondents in relation to annual income, except for size of the irrigated cultivation. Significant differences were found between the two groups of respondents with the entire socio-cultural characteristics, namely with extension contacts, communication channels, social confidence, social solidarity, social participation, farmers' attitude toward the WUC, and farmers' participation status concerning irrigation networks management. In addition, with technical factors, there was a significant mean difference between farmers' behavior regarding farm water management and farmers' perception of rural irrigation status in two groups of respondents.

Table 4. Comparison of the two groups of water users in WUC and non-WUC irrigation networks in relation to their characteristics.

Independent variable / Dependent variable	WUC irrigation network (n=158)		Non-WUC irrigation network (n=172)		t	P value	Effect Size (d)
	Mean	S.D.	Mean	S.D.			
Age of the farmer	47.85	13.63	43.61	14.04	2.78**	0.006	0.30
Education level	4.86	4.23	4.06	3.57	2.27**	0.024	0.20
Experience in agriculture	27.51	13.93	23.36	13.85	2.71**	0.007	029
Size of the irrigated cultivation	3.38	2.42	3.51	1.95	-0.539	0.590	-0.05
Distance from farm to agricultural services center	5.58	2.80	5.31	2.67	0.870	0.385	0.09
Annual income (million rials)	3.94	1.73	2.43	0.99	9.79**	0.000	1.07
Extension contacts	10.25	5.18	7.84	4.70	4.43**	0.000	0.48
Communication channels	22.32	9.68	19.73	8.89	2.53*	0.012	0.27
Social confidence	13.50	5.56	10.74	5.84	4.39**	0.000	0.48
Social solidarity	13.92	5.32	10.80	5.35	5.29**	0.000	0.58
Social participation	19.65	7.46	15.44	7.89	4.96**	0.000	0.54
Farmers' perception of rural irrigation status	14.68	4.89	10.80	4.85	7.21**	0.000	0.79
Status of farmers' participation in irrigation management	19.92	6.70	12.72	6.60	9.82**	0.000	1.08
Farmers' behavior regarding farm water management	75.27	22.25	65.24	20.51	4.25**	0.000	0.46
Farmers' attitude toward the WUC	61.46	16.06	53.27	16.75	4.52**	0.000	0.49

* T-test significant at $p < 0.05$

** T-test significant at $p < 0.01$

To assess the magnitude of statistical differences, effect sizes were calculated, interpreted, and reported using Cohen's procedures (Zhai and Scheer, 2004). Interpretations for t-tests were based on the Cohen conversion: negligible size; $d< 0.20$, small effect size; $0.20\leq d< 0.50$, medium effect size; $0.50\leq d< 0.80$, and large effect size; $d\geq 0.80$ calculated through the following formula:

$$d = \frac{Mean_1 - Mean_2}{\sqrt{\frac{SD_1^2 + SD_2^2}{2}}}$$

The analyses revealed that the annual income (Cohen's d= 1.07) and status of farmers' participation in irrigation networks management (Cohen's d= 1.08) had the largest magnitude of difference than other variables (large effect size). Therefore, WUCs were of the most abundant influences on these variables. Also, farmers' perception of rural irrigation status (Cohen's d= 0.79), social solidarity (Cohen's d= 0.58) and social participation (Cohen's d= 0.54) were found inside the range of medium magnitude of statistical differences (medium effect size). Magnitude of the statistical differences of age, education level, experience in agriculture, extension contacts, communication channels, social confidence, farmers' behavior regarding farm water management, and farmers' attitude toward the WUC were the lowest (negligible effect size).

CONCLUSION

According to the study findings, it was found that WUCs as the considerable social capital can improve the level of farmers' participation in irrigation water management. Significant differences was statistically found between two groups of WUs, those who involved in irrigation network with WUC and those in non-WUA networks in relation to the individual variables of age, education level, and experience in agriculture. Among the economic characteristics, there was a significant difference between two groups of respondents in relation to their annual incomes. This finding concurs with that of Pradhan (2002). Significant differences were found between two groups of respondents from the stand point of all their cultural and social characteristics, namely extension contacts, communication channels, social confidence, social solidarity, social participation, farmers' attitude toward the WUC, and farmers' participation status concerning irrigation networks management. This means that WUAs enhance social capital components among farmers. This conclusion is consistent with others studies (Wijayaratna, 2004; Howarth *et al*., 2002; Pradhan, 2002). In addition, the results indicated that among technical factors, there was a significant difference between farmers' behavior regarding farm water management and farmers' perception of rural irrigation status in two groups of respondents. Thus, the establishment of WUCs provides the most suitable mechanism for the human resource development. Accordingly, several studies have shown that the WUC plays an important role in the improvement the WUs' knowledge, attitudes, and skills regarding farm water management (Wijayaratna, 2004; Carter *et al*., 1999). Therefore, in order to improve the PIM in irrigation networks, decentralization and devolution of water networks management increase WUs' participation in decision-making and investment, and improve management incentives, accountability, agricultural and economic productivity and cost recovery which is the most effective and promising way toward the sustainability of the water resources. The development and implementation of improved water management policies through the formation of WUCs in the irrigated agricultural sector is an important element to achieve the water management objectives. Hence, agricultural policies in Iran must aim at raising the potential of water management technologies through the development of multi-functional WUCs to enhance agricultural water productivity, promote equitable access to water and to conserve the natural resource.

REFERENCES

1. Burger, R. 1998. Water users' associations in Kazakstan: an institutional analysis. Harvard Institute for International Development, Central Asian Republics.

2. Carter, R., Kay, M. and K. Weatherhead. (1999). Water losses in smallholder irrigation schemes. Agricultural Water Management. 40: 15-24.

3. Ehsani, M. and H. Khaledi. (2003). Agricultural water productivity. Iranian National Committee on Irrigation and Drainage, Tehran.

4. Howarth, S. E., Parajuli, U. N., Baral, J. R., Nott, G. A., Adhikari, B. R., Gautam, D. R. and K.C. Menuka. 2005. Promoting good governance of water users' associations in Nepal. Department of irrigation of his majesty's government of Nepal.

5. Keshavarz, A., Ashrafi, M., Heydari, N., Pouran, M. and E. Farzaneh. 2005. Water allocation and pricing in agriculture of Iran. Proceedings of an Iranian-American workshop on Water Conservation, Reuse and Recycling, U.S. National Research Council of the National Academies, The National Academies Press, Washington, D.C.

6. Krejcie, R. V. and D. W. Morgan. 1970. Determining sample size for research activities. Educational and Psychological Measurement. 30: 607-610.

7. Ostrom, E. and R. Gardner. 1993. Coping with asymmetries in the commons: self-governing irrigation systems can work. Journal of Economic Perspectives, 7 (4): 93-112.

8. Pradhan, P. (2002). Water users' associations towards diversified activities: experiences of Nepal and other countries. Indiana Workshop in Political Theory and Policy Analysis.

9. Skaggs, T. H., Genuchten, M. T., Shouse, P. J. and J. A. Poss. (2006). Macroscopic approaches to root water uptake as a function of water and salinity stress. Agricultural Water Management, In Press.

10. Smith, M. and G. Munoz. (2002). Irrigation advisory services for effective water use: a review of experiences. Workshop organized by FAO–ICID. Montreal, Canada.

11. Tanaka, Y. and Y. Sato (2005). Farmers managed irrigation districts in Japan: assessing how fairness may contribute to sustainability. Agricultural Water Management, 77: 196–209.

12. Wijayaratna, C. M. (2004). Linking main system management for improved irrigation management. The Asian Productivity Organization, Japan.

13. Zhai, L. and S. D. Scheer. 2004. Global perspectives and attitudes toward cultural diversity among summer agricultural students at the Ohio State University. Journal of Agricultural Education, 45(2): 39-51.

COMMUNITY BASED MICRO-PLANNING IN PIM: ENTRY POINT ACTIVITIES FOR SUSTAINABILITY

Dr. Deepak Kumar Das[1]

ABSTRACT

The necessity of devolution of certain management responsibility of irrigation system to the farmers' organization is now widely accepted as an effective tool for sustainable irrigated agriculture. In India during 1990s systematic institutional and organizational changes have been undertaken to increase farmers' participation in irrigation management through formation of Water Users' Association (WUA) or Pani Panchayats under different externally assisted economic restructuring and irrigation infrastructure development programmes of World Bank, European Commission, Japan Bank for International Cooperation etc. or through Central or State government initiative. Today, Participatory Irrigation Management (PIM) or Irrigation Management Transfer (IMT) at various levels is being implemented in different types of irrigation systems. For this programme, appropriate institutional arrangements and mechanisms to bring about efficient utilization, equitable distribution and sustainable irrigation service are framed by different states of India. Further steps are being taken continuously for improvement in the strategies to achieve the goals of PIM. This paper, apart from highlighting some lessons from PIM experiences in Orissa, the poorest state in the dominion of republic of India, narrates a strategic micro level planning along with identified entry point implementation programme that are undertaken for sustainable irrigated agriculture simultaneously aiming at upliftment of livelihood of small and marginal poor farmers.

The study concludes that the objective of poverty reduction by way of promoting schemes for agricultural productivity improvement through irrigation can be achieved by adopting community based participatory approaches that support agricultural development like improving irrigation performance, the use of new production technologies, enhancing access to markets, promoting environmentally sustainable production activities, having gender perspective, measures to improve income and livelihood through micro-finance, rural infrastructure up-gradation, participatory processes to empower the rural poor with core skills to process agri-products for value addition.

1- Associate Professor in Engineering Faculty, Water and Land Management Institute, Pratapnagari, Cuttack, Orissa. India - 753051, India; E-mail: deepak_das62@yahoo.com

INTRODUCTION

India is the second largest populated country in the world with nearly 1.1 billion people. Out of this around 26.1 per cent are poor, living with less than a dollar a day (ADB 2004; UNDP 2003). The country is thus home to more than one fourth of the world's poor. Further the degree of poverty varies from state to state, the poverty estimate in percent of population below poverty line is as high as 47.15% for Orissa and 42.6% for Bihar to lower percentage of 3.5% for Jammu and Kasmir and 4.4% for Goa during 1999-2000 as reported in National Human Development Report 2001 of Govt. of India (2002, Planning Commission). Poverty alleviation is the most important objective of Indian planning through creation of employment opportunities, income generation activities and growth promotion. However, underdeveloped infrastructure such as power, transport, irrigation, water supply, sewerage and lack of accessibility to health facilities have impaired economic growth and the poverty eradication drive. In the 10th Five-Year Plan (April 2002-March 2007), the Government of India has called for equitable and sustainable growth, and to achieve this goal, it has designated the following as the priority development issues: not only eradication of the existing poverty but long-term poverty reduction through economic growth and environmental conservation to make these efforts sustainable.

Water resources management and development are central to sustainable agricultural growth and poverty reduction. Currently, integrated water resources management is highly emphasized for enhancing food security, poverty eradication, economic growth and rural upliftment in the developing countries including India. Further, most of the developing countries have insufficient hydraulic infrastructure and hence, the governments, international funding agencies need to assist these countries in developing and maintaining adequate number of well-performing hydraulic structures and in mobilizing public and private financing, while meeting environmental and social standards. Moreover, the below-optimal performance of the existing irrigation systems is of serious concern to farmers who depend on them for their crops and livelihoods and to governments as well as funding agencies that have made massive investment in their development. The most severe problems encountered by irrigation systems in the developing countries are the increasing costs of new schemes, the huge backlog of incomplete schemes, and the increasing neglect of existing systems. Large-scale canal irrigation systems, in particular, are in poor condition: they are not properly maintained, operations are inadequate, water supplies do not reach the tail end of systems, and the timing of water supply is unreliable. The wide gap between actual and desirable performance threatens the sustainability of irrigated agriculture. These state of affairs warrants proper investment strategies with institutional reforms and comprehensive plans for implementation starting from Micro-level (Grass-root level).

It is established that in democratic and developing countries like India, genuinely participatory governance of a common property resource like irrigation at the micro level can yield benefits in terms of both efficiency and equity, by giving the water users a sense of ownership, by allocating resources according to people’s demand and need and by utilising their skills and knowledge. The reform or decentralisation of governance of irrigation infrastructure or Irrigation Management Transfer to Farmers' Organisatins is now widely accepted and used as an effective tool for improving management efficiency, accountability, agricultural and economic productivity and cost recovery and finally sustainable irrigated agriculture. As a result, it is now observed that an increasing number of governments around the world are adopting programmes to devolve responsibility for irrigation management to farmers organisations or to Water Users Associations (WUAs) in their reform process, which is known as Participatory Irrigation Management (PIM) and is found place in their national policies. Indian irrigation sector in recent years is also in the same PIM trail where attempts are being made to increase farmers' direct participation in decision-making and investment.

Further, conventionally Indian economy is largely based on rural villages, as it draws most of its inputs from farms and village industries. Consequently, it establishes the fact that transforming agriculture to effective enterprise or industrialization of agriculture has potential to provide the rural poor with on-farm and off-farm employment, induce economic growth and promote food security. On the other hand, studies of De Boer et. al. (1997), Simons and Supri (1999), White (1999) and Grossmann and Poston (2003) reveal that India's agriculture extension system has missing links to secondary or primary education and is not reaching effectively to the women and the rural poor including the lower castes. Though India is one of the potential producers of large number of agricultural researchers and scientists but it lacks in providing basic skills required to improve farming methods or job opportunities in the rural off- farm sector. Now high priority should be given to equip the rural poor with appropriate skills by improving the currently inadequate agriculture extension system. The situation altogether warrants a comprehensive micro plan with reforms in irrigation governance.

PIM IN INDIA

Participatory Irrigation Management is being implemented in irrigation projects in most of the countries of world including India. Since 1985 Ministry of Water Resources has been inspiring farmers' participation in water distribution and management of tertiary system in the projects covered under the Centrally Sponsored Command Area Development Programme. The concept of involvement of farmers in management of the irrigation system has been accepted as a policy of the Government of India and has been included in the National Water Policy adopted in 1987. Provisions made in the National Water Policy of 1987 were as follows:

"Efforts should be made to involve farmers progressively in various aspects of management of irrigation systems, particularly in water distribution and collection of water rates. Assistance of voluntary agencies should be enlisted in educating the farmers in efficient water-use and water management."

PROVISION IN NATIONAL WATER POLICY (2002)

Following modifications were made in the National Water Policy (2002) regarding the participatory approach to water resources management:

"Management of the water resources for diverse uses should incorporate a participatory approach: by involving not only the various governmental agencies but also the users' and other stakeholders, in an effective and decisive manner, in various aspects of planning, design, development and management of the water resources schemes. Necessary legal and institutional changes should be made at various levels for the purpose, duly ensuring appropriate role for. women. Water Users' Association and local bodies such as municipalities and Gram-Panchayats should particularly be involved in the operation,

maintenance and management of water infrastructures/facilities at appropriate levels progressively, with a view to eventually transfer the management of such facilities to the user groups/ local bodies."

PROCESS OF IMPLEMENTATION

Different states of India followed different routes for implementation of PIM. While PIM in Andhra pradesh followed the Big Bang Approach, the state of Orissa implemented PIM through a gradual approach in phased manner.

PROVISIONS IN PIM ACTS

Recognising the need for sound legal framework for PIM in the country, the Ministry of Water Resources, Government of India brought out a model act to be adopted by the State Legislatures for enacting new irrigation acts/amending the existing irrigation acts for facilitating PIM. In accordance with the model act and as a result of various conferences/ seminars organised by the Ministry, there has been an increased consciousness in States about the need for actively involving farmers in management of irrigation systems. Nine State Governments, namely, Andhra Pradesh, Goa, Madhya Pradesh, Karnataka, Orissa, Rajsthan, Tamil Nadu, Kerala and Maharastra have enacted exclusive legislation for involvement of farmers in irrigation management. Other states are in the trail of enacting either exclusive legislation for PIM, or are exploring scope to exercise power for PIM through existing laws like Government of Bihar has issued a notification "The Bihar Irrigation, Flood Management and Drainage Rules, 2003", in exercise of the powers conferred by The Bihar Irrigation Act, 1997. Gujarat had experimented with the idea of farmers' co-operative movement in irrigation management. The Stale of Gujarat had also a PIM Resolution during the year 1995 based on experiences from its pilot projects. In general the legal framework provides for creation of farmers organisations at different levels of irrigation system as under

1. Water Users' Association (WUA): will have a delineated command area on hydraulic basis, which shall be administratively viable. Generally a WUA would cover a group of outlets or a minor.
2. Distributary Committee: will comprise 5 or more WUAs. All the presidents of WUAs will comprise general body of the distributary committee.
3. Project Committee: will be an apex committee of an irrigation system and presidents of the Distributary committees in the project area shall constitute general body of this committee.

The Associations at different levels are expected to be actively involved in:

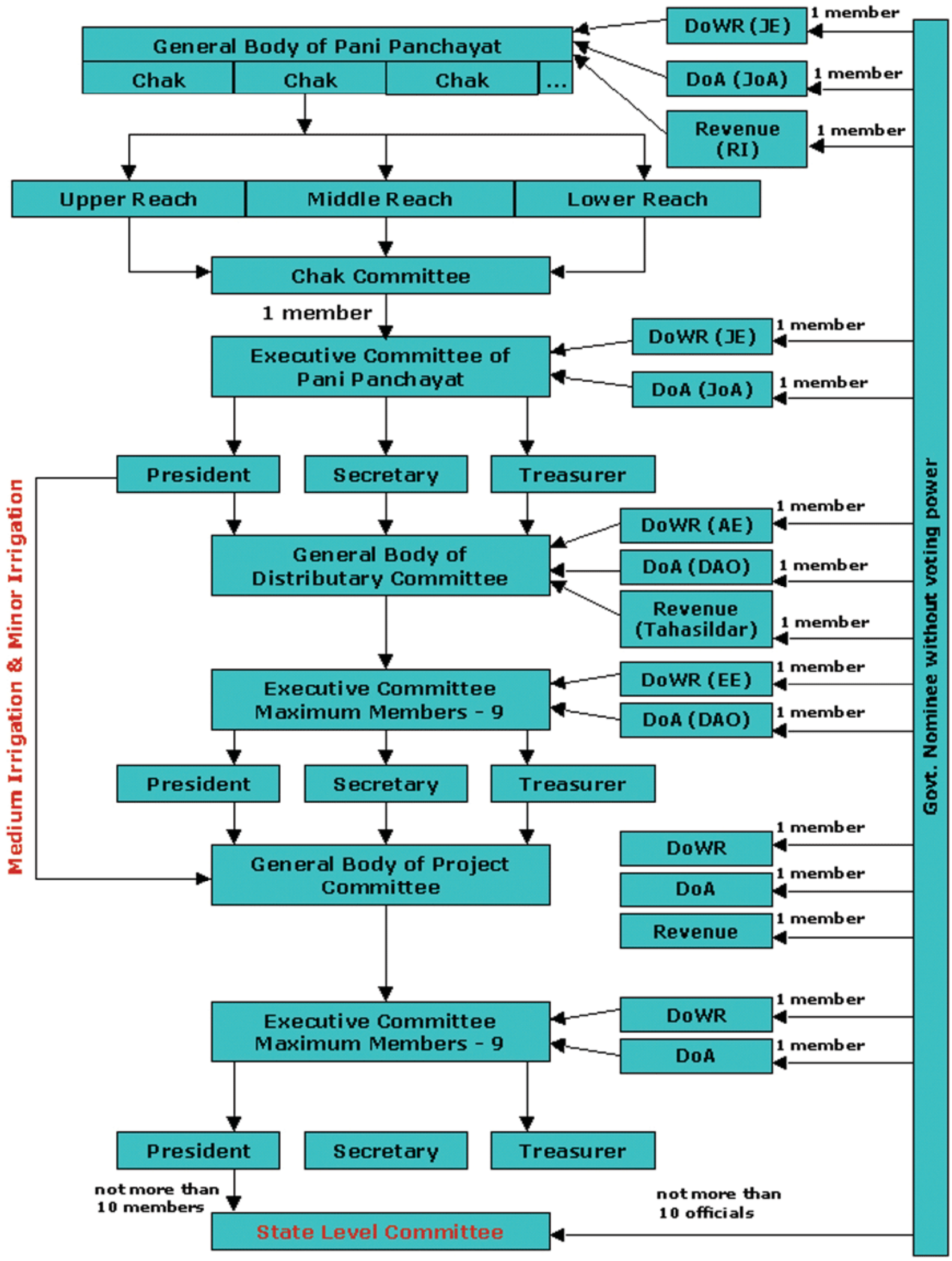
i. maintenance of irrigation system in their area of operation;
ii. distribution of irrigation water to the beneficiary farmers as per the warabandi schedule
iii. assisting the irrigation department in the preparation of water demand and collection of water charges

iv. resolve disputes among the members and WUA
v. monitoring flow of water in the irrigation system etc.

PIM IN ORISSA

Orissa is a state in the dominion of India. In Orissa PIM approach has been put into practice through formation of Water Users Association (WUA), which is known as Pani Panchayat (PP). PP is the primary level farmer organization (Das et.al.2004). The structural arrangement of farmer organization is three tiers for Medium and four tiers for Major Irrigation Projects as shown in Fig. 1.

A Pani Panchayat/WUA is an association of all persons owning land within a hydrologically delineated portion of the command area ranging in size approximately from 300-600 ha in case of major/medium / minor irrigation project. It may be in respect of minor or sub-minor or direct outlets from the main or branch distributary of the project. In case of minor flow or lift irrigation, the area is limited to project command area when the project command area is less than 300 ha. The WUA/Pani Panchayat is a part of the farmers' organisation recognized by Orissa Pani Panchayat Act 2002, also all farmers organizations are body corporate as defined therein.



(DoWR: Department of Water Resources, DoA: Department of Agriculture, JE: Junior Engineer, A.E: Assistant Engineer, EE: Executive Engineer, JAO: Junior Agriculture Officer, DAO: District Agriculture Officer, RI: Revenue Officer)

Fig. 1 Structure of Farmers' Organisation under PIM Programme in Orissa, India

In Orissa the state government is implementing the Pani Panchayat Programme with a great zeal. The area under PP has expanded rapidly as shown in Table 1. Data on progress of PIM in Orissa indicate that by June 2006, 13435 PPs have been formed covering an area of 10.55 lakh ha. Irrigation management has been transferred to 12218 PPs covering 8.60 lakh ha out of total command area of 21.15 lakh ha. Thus, the data reveal that the PIM programme in Orissa is intensifying and very soon the entire irrigation command of the state will be farmer managed.

Table 1: Progress of Pani Panchayat Programme in Orissa as on June 2006

Types of Irrigation Project	Irrigation Potential Created* '000 ha.	No. of Pani Panchayats Formed	Area ' 000 ha.	Irrigation management transferred	
				No. of PPs	Area ' 000 ha.
Major and Medium	1234	1426	623	1122	494
Minor (Surface)	497	976	189	719	136
Minor (Lift)	384	11033	243	10377	230
Total	2115	13435	1055	12218	860

* Irrigation potential from other sources are not included

COMMUNITY BASED MICRO PLANNING AND ENTRY POINT ACTIVITIES

Preliminary studies conducted in various irrigation projects in Orissa show that rice-rice is the dominant cropping pattern followed by the farmers. The main rice crop is raised from June to December and the summer rice crop is grown from January to May. The water in canal is supplied accordingly from July to November and January to May to support this cropping pattern. The present agriculture production system in these projects has the following shortcomings:

1. Irrigation water is available round the year in reservoirs or from the hydro-power generation units which can support 3 crop sequences. At present, the rabi season (November-February) does not exist and is overlapped by kharif and summer season crops. As a result, the irrigation potentials are not fully utilized.

2. Rice is the dominant crop grown in summer season. Since the outlet size is designed to provide supplemental irrigation to the kharif rice crop @ 6-7 mm/ha/day, it fails to irrigate entire command area below each outlet and 30-40% area remains unirrigated. There is again social inequity in water distribution between head reach and tail end farmers.

3. Rice-rice cropping pattern over years leads to problems like waterlogging and reduction in soil productivity of command area.

4. Due to distress sale of paddy in recent years, the present cropping pattern gives low returns to the farmers.
5. Besides inefficient use of water and land resources, the prospect of present irrigated agriculture in these projects is limited as the farmer has been facing rising input costs, declining returns from the inputs, uncertain market, increasing integration of domestic market with the international market, inadequate storage infrastructure, exploitation of farmers by middle men and private money lenders, low awareness level, risk in production due to occurrence of natural calamities, plant disease and pest attack etc.

In order to increase the performance of the irrigation projects, main thrust under micro-plan is to undertake software and hardware activities to transform the present rice-rice mono-culture system to diversified agriculture production system. Technical and socio-economic constraints experienced for agriculture diversification in these projects will be removed through establishing proper co-operation among the farmers and line departments. To meet this challenge the micro plan implementation objectives through PIM are:

a) To inculcate the feeling of the self-help among the farmers and to develop a mechanism meeting challenges through group action;

b) To build the capacity of PPs to make use of services from Government and non-Government agencies;

c) To develop software measures for efficient use of water, land, labor and other available resources;

d) To diversify the agriculture production system to produce variety of cash and commercial crops to make agriculture profitable;

e) To identify and promote market linkages for ready availability of inputs/ services and quick disposal of agricultural and non-agricultural products;

f) To bring out Entry Point Activities (EPAs) through Participatory Rural Appraisal (PRA) that are required by the members of PPs aiming at improving livelihood and sustainable irrigated agriculture.

Since December, 2005, in Orissa, a community based micro plan as well as identification and implementation of Entry Point Activities with the strategy for overcoming the key problems faced by the farmers has been launched on pilot basis for the sustainability of irrigated agriculture in Upper Indravati Irrigation Project and Upper Kolab Irrigation projects and will be replicated in other projects after observing the pilot studies.

Upper Indravati and Upper Kolab are two multipurpose major irrigation projects situated in the less developed, tribal and backward caste dominated region of Orissa, where majority of the farmers are poor and practise subsistence farming. These projects are funded for not only development of irrigation infrastructure as sole objective, but also it aims at proper management, operation, maintenance and sustainability irrigation system.

The post evaluation of completed portion of this project shows that the project provides the farmers in the region an opportunity for dry season farming, enhanced employment opportunities to landless laborers, tenant farmers and small-scale farmers and arrested migration. This would not have been possible without irrigation. It has significantly increased the income and living standards of the farmers of the region, of course majority of them are Scheduled Castes and Scheduled Tribes. The coverage of area under different crop and production of different crops, particularly rice has increased significantly after the implementation of the scheme. Due to the impact of irrigation the farm households' income shows an increasing trend. Increased income has made it possible for the children to go to school and the family to buy consumer durable (JBIC 2003a). Though the process of formation of WUAs/ PPs, is slow in these projects at the beginning due to absence of proper policy and act supporting legal and institutional environment, now gaining momentum due to present PIM policy and appropriate legislation by the state (Das, 2005a & 2005b).

In these projects, it has been observed that though there is improvement in soci-economic condition of the farmers in general, inequitable distribution of water and poverty persists in the project area. The key problems faced by the farmers include unequal water allocation, inefficient water use, shortage of funds, inadequate institutional capacity, lack of integrated water resources management, dilapidated existing irrigation facilities and soil degradation, information gap in agricultural diversification and technologies, deficient distribution network and market place, low technological level of food processing and low value addition, rural usury, inaccessibility to different schemes of government like health, sanitation, input supply etc.

Particularly for the first time implementation of Micro-plan and EPAs have been initiated in these two projects assisted by Japan Bank for International Cooperation (JBIC). In these projects JBIC, Department of Water Resources (DOWR), Government of Orissa and Water and Land Management Institute (WALMI, Orissa) are working together for development of Micro Plan and identify Entry Point Activities (EPAs) in consultation with the local farming community. Whenever required, assistance of NGOs is being sought. WALMI, Orissa is engaged as implementing agency for a period of two crop seasons and will gradually withdraw as the community learn and adopt the required practices for sustainable agriculture. In these pilot irrigation projects Self Help Groups (SHG)s have been formed within the WUAs or PPs to play vital role in improving irrigation efficiency, agricultural productivity and improvement of livelihood. One of the important feature of micro level plan is identification of EPAs. The identified EPAs consist of a broad array of activities such as facilitation of Micro-credit with revolving fund for undertaking rural farming, non-farming activities, empowering rural women, rural micro-enterprise development and facility for farm mechanization. The other options for micro level plan considered are effective packages of technological and management practices, adoption of commercial farming using market forces and mechanism to enhance efficiency, awareness and capacity building of the stakeholders and other livelihood enhancing measures. Assessment and incorporation of all local specific characteristics for providing effective service delivery, increased productivity, protection of environment and improved socio-economic condition for sustainability of the irrigation projects in the planning process have been considered for implementation. The structural arrangement for sustainable and productive irrigated agriculture for Socio-economic development is given in Fig.2. The results of this strategic plan are under study and proposed to be adopted in other irrigation projects which are being considered for modernisation. In many irrigation project, Pani Panchayat programme has already been implemented and in these projects, it is observed that the PPs need more capacity building, training and guidance to carry out the activities related to their rights and responsibilities properly (Das 2005a, 2005b).

Irrigated agriculture will be sustainable, if Pani Panchayats orient their agriculture production towards the market economy and are able to convert their traditional agriculture to a profitable enterprise (Das et al., 2003 & 2004). It is necessary to identify and develop marketing network for the farming community, which will provide input supply and required services and facilitate trading of agricultural products. For overcoming these foreseeable problems and concurrent difficulties, currently the PPs are being trained and guided by WALMI, Orissa. As soon as the farmers gain sufficient experience on the recent technology on agriculture production system and networks for marketing are developed and established, WALMI will withdraw from the project. Thereafter the PPs can run independently and can cater to the needs of the farmers.

MICRO PLANNING AND EPA STRATEGIES FOR SUSTAINABILITY

Currently the following strategic plans are followed for development and implementation of Micro Plan and identification of EPAs in the Pilot Projects. The same will be replicated in other irrigation projects as irrigation projects nowadays attract high priority for sustainable agriculture. This pilot implementation is assisted by JBIC and being implemented with the help of experienced multidisciplinary faculty members and action research personnel of WALMI (Orissa). The activities are

PARTICIPATORY RURAL APPRAISAL (PRA)

PRA techniques have been applied by WALMI Faculty Members and Facilitators (Action Research Personnel) to identify EPAs for the PP/WUA.

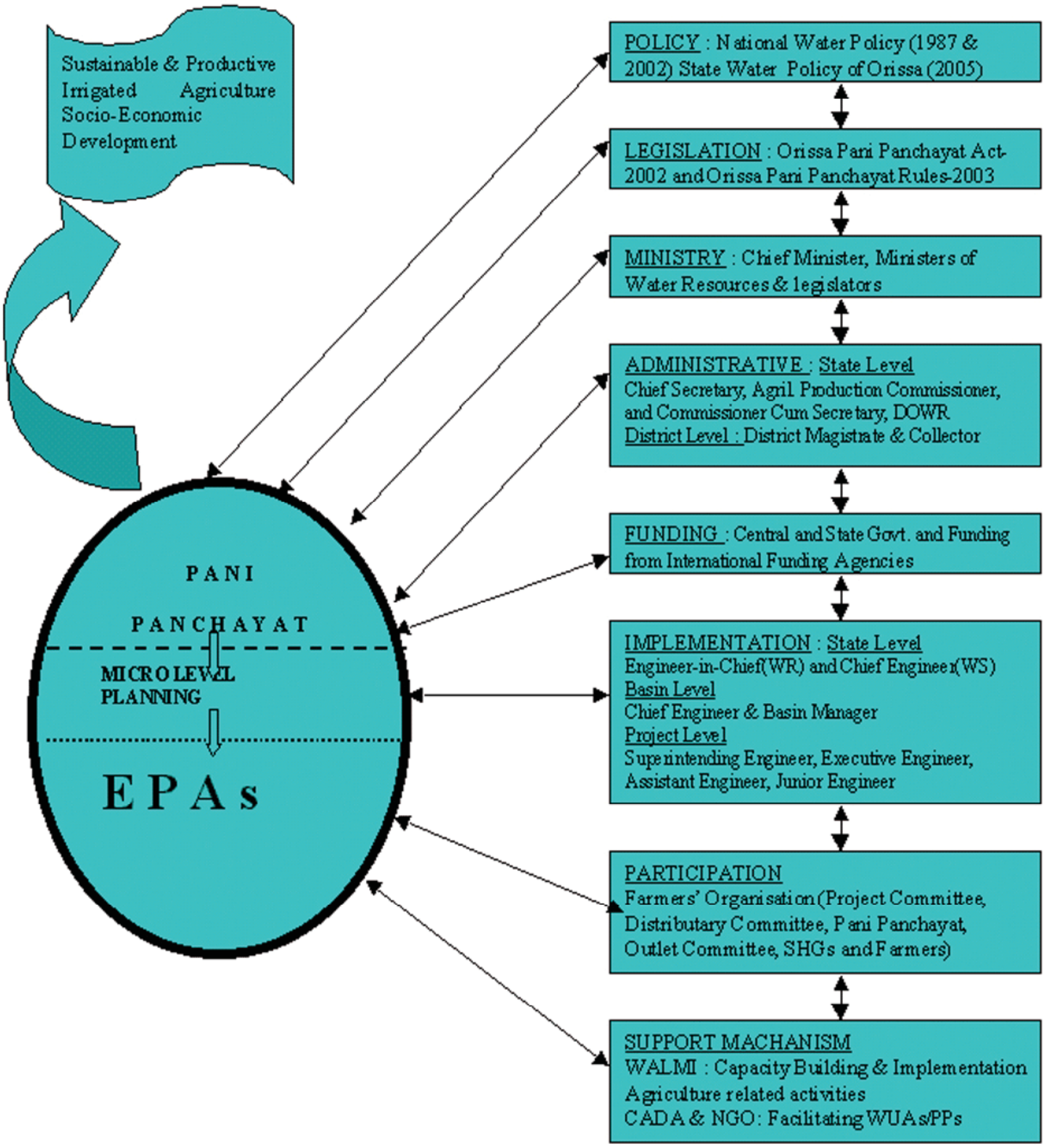


Fig. 2 Structural Support Arrangement for Sustainable and productive Irrigated Agriculture for Socio-economic Development

PARTICIPATORY WALKTHROUGH *(PWT)*

i) Participatory walkthrough for testing the hydraulic structures and to know the canal conveyance, controlling mechanism and water measuring aspects and taking up necessary steps in restoration or rehabilitation.

ii) Audit of existing micro-distribution system and suggestion of improvement.

MOTIVATION AND FORMATION OF SHG

i) Motivation and Formation of Self Help Group (SHGs) explaining the benefits to the members of the SHGs. This includes various stages i.e. group formation, group stabilization etc. For EPAs the chak committees are also taken as a self help group.

ii) Encouraging SHGs for community farming, input supply service, marketing service, and transport service, service for packaging and value addition.

iii) Encouraging private entrepreneurs/ SHGs for agriculture processing industries and small warehouses to store produce scientifically.

iv) Farmers training on chak/outlet basis to discuss the soil, climate, canal conveyance and supply, feasible cropping pattern for the outlet.

SOIL SURVEY

Available soil survey data will be utilized for crop planning and recommending appropriate package of practice.

IMPORTANT AGRICULTURE PROMOTION ACTIVITIES

i) Conducting exposure visits to advanced areas in practice.

ii) Demonstration on crop diversification and package of practices for irrigated dry (ID) crops, vegetables, fruits, maize, sugarcane, medicinal plants, spices etc. to be identified after PRA.

iii) Market mapping, Demand survey for products, identification of Buyers, Establishing marketing network

iv) Streamlining credit facilities and crop insurance, acquisition of micro-finance skills such as internal lending, fixation of interest rate and loan recovery schedule and building of corpus funds.

v) Identified training for Farmers and stakeholders

1. Training on capacity building for office maintenance for PP executive members and self help groups. Role and responsibilities of PPs/WUAs.
2. Irrigation system, Water Availability, Water Requirement, Irrigation Scheduling, Canal operation, Irrigation Water Management etc.
3. Crop diversification, package of practices for cash crops
4. Diversification for Kharif Paddy and Water Management including package of Practices.
5. Farm machinery and implements, and their maintenance
6. Effects of disasters and adverse climatic situation and mitigation plans
7. Assessment of additional training needs during EPA Period

8. Workshop on Government schemes, input supply, incentives, credits, subsidies, insurance, produce storing, processing, value addition, marketing, education, health etc.
9. Selection and motivation of large buyers and service providers.

DOCUMENTATION AND VIDEO MODULE PREPARATION

Documentation of all the activities in the process of implementation and video module production are in process for replication purpose.

MONITORING AND EVALUATION

Periodic Monitoring and Evaluation of implementation of micro-plan and EPAs for strengthening the Programme are being carried out to ensure that the objectives are fulfilled. Various indicators based on approved EPAs and income generation activities as well as indicators like Crop Diversification, Productivity, Water Distribution Indices etc. are also being monitored constantly.

PROGRAMME IMPLEMENTATION

a) Structure of programme implementation

The programme is being implemented by implementation teams (IT), comprising multi disciplinary action research staff of WALMI. A multi disciplinary team consisting of engineering, agriculture and sociology faculty of WALMI will act as the supervising expert team (SET).

b) Operation of corpus fund

Shifting from traditional rain-fed rice farming to intensive multiple cropping under irrigation, requires capital expenditure for various activities. Very often, due to non-availability of adequate and timely credit from formal financing institutions, the farmers depend on money lenders and borrow at exorbitant interest rates. Most of the resource poor farmers fail to apply recommended technology leading to poor production. Easy access to soft loans through micro-credit finance will help the poor farmers to purchase good quality inputs for application at right time. The grant component to be used as the corpus fund for providing micro-credits to SHGs will be utilised as follows.

1. Credit will be provided to SHGs, not to the individuals, for undertaking rural farming, non-farming activities, rural woman development and rural micro-enterprise development. The farming system includes manufacturing bio-fertilisers, vermi compost, commercial crop nursery, seed production, soil testing, crop protection, horticulture (vegetable production), floriculture etc. The non-farming activities include dairy, poultry, intermediate processing of fruits and vegetables for value addition etc. The credit may be extended for self-employment for rural women and micro enterprise development.

2. Credits may be extended for improving rural living condition, such as sanitation, cooking gas connection and other activities.
3. The activities will also take care of persons engaged in selling firewood to undertake micro-enterprise based on minor forest produces and rural enterprises.

For sustainable micro-credit or rural credit delivery, appropriate system has been designed for micro enterprise development to reduce the finance problem and risk of small and marginal farmers. This includes multiple dose of credit over a period of time with second and subsequent dose(s), enabling them to access higher amount of credit. They should have confidence that so long as they prove their credit worthiness by way of proper utilization of the asset and prompt repayment, the created corpus fund will stand by them and will grow to provide additional credit. The SHGs are allowed to stabilize and improve their credit absorption capacity and to increase their fund as well as increase their credit intake over the years either for the same activity or a new activity. The credit system has in-built mechanism for easy installments and incentive to members making regular repayments etc.

IMPLEMENTATION OF EPAS IN PILOT PANI PANCHAYATS

1. Since December 2005, EPAs have been taken up in Pilot PPs having micro distribution network or field channels. If a Pilot PP does not have micro-distribution network then in the Entry Point Activity, it is given priority to develop micro distribution system, which is necessary for scientific on-farm water management.
2. Entry point activities have been carried out with the maximum limit of Rs.0.6 million per PP. The activities taken up are decided by the farming community based on PRA carried out by implementing agency. In the presence of competent officers of DOWR, and in consultation with the implementing agency the PPs have approved the EPAs.
3. The entry point activities include Community welfare, Micro-credit or Rural credit disbursement through SHG, development of micro-enterprise to improve livelihood in command area, input supply, farm mechanisation activity for sustainable agriculture and income generation activities for improvement of livelihood of farmers in the command area. An agreement has been signed by PP and the Executive Engineer on behalf of the Project authority as well as PP with SHGs for this purpose. The project authority (DOWR) has transferred the entire amount of Rs. 0.6 million to the pilot PPs for taking up approved activities
4. The chak committees are treated as SHGs for crop diversification and other income generation activities. Scope for additional SHGs are open if needed for taking up different agricultural support services duly approved by respective PP. The amount identified for the purpose are earmarked and the pilot PP are sanctioning loan to SHGs from this amount. The PPs are authorized to utilise this amount along with accrued interest for the purpose of income generation through Micro Credit mechanism.
5. SHGs are encouraged for taking up community farming.

6. For community welfare as one of EPA, the PPs are authorized for selection of items such as procurement of machinery/ farm equipment for farm-mechanization to be used by the general members of PP. The equipments include tractor, cultivator, ploughs, threshers, seed drills etc. The running and maintenance are being borne by farmers by charging rentals.
7. Loans for income generation activities shall be provided to SHGs. Loans to individuals shall not be encouraged as the recovery pattern from individual borrowers has been observed very low in other similar projects. As regards, the rate of interest on loans, PP shall have the discretion to decide the same. However, some rate of interest necessarily needs to be charged in order to offset the bad debts (which may occur) and also to increase the corpus fund.
8. In the EPAs, it is taken care of that there will not be any effort to duplicate the activity that the other departments have already taken up. The convergence of the activities of various departments is emphasized. In case of inadequacy, the convergence and co-ordination will be strengthened.
9. The DOWR is facilitating the augmentation of institutional capacity of the PP for maintaining services, facilities and works undertaken through EPAs. PPs are also given scope for taking up resources generation activities. For this purpose PPs would be encouraged to take-up small scale work contracts pertaining to improvement works in their jurisdiction. As per the provisions of Pani Panchayat Act, DOWR is also making efforts to mobilize other government departments to extend their schemes in the project area so as to enhance the developmental works in these selected area and also maintain the assets created under entry point activities in the PP area. Such schemes may include health, sanitation, education, Swarna Jayanti Gramya Swarozargar Yajana (SGSY) and other new schemes.
10. The DOWR shall maintain proper accounts PP wise of all the entry point activities undertaken in the project area. This will be subjected to audit checks by the state audit department as per the procedure laid down.
11. A mechanism for monitoring of the implementation of EPAs has been established under the chairmanship of Engineer in Chief for effective implementation and providing timely suggestions.
12. Display boards are kept in each Pani Panchayat by the Water Resources Department clearly specifying the EPAs carried out in that Pani Panchayat along with the amount spent by the DOWR.

CONCLUSION

In irrigation projects, active participation of the farmers who are the ultimate beneficiaries is indispensable, with Water Users Associations/Pani Panchayat as the center of activity. In order to strengthen the Water Users Associations/Pani Panchayats and promote participation by farmers, first a study should be made to ascertain the social and economic conditions of the beneficiaries, such as caste/tribes, land ownership of existing inhabitants, social and cultural institutions and organizations, etc. The study needs to indicate problems in irrigation, markets, technology, and capital, etc. in detail. Once the socio-economic survey is done, an action plan clarifying the rights and responsibilities of different stakeholders should be prepared at a stage sufficiently ahead of the launching of irrigation water supply.

The executing agency or Government Department of Water Resources needs to promote early transfer of operation and maintenance of manageable portion of irrigation system to Water Users Associations/Pani Panchayat. Also it is necessary to build the capacity of Water Users Associations and provide full support for technological upgradations in order to promote self-reliance and the realization of sustainability.

It is evident from the study that the objective of providing assistance for alleviation of poverty and rural upliftment through micro-planning and entry point activities as adopted in JBIC assisted irrigation projects in Orissa is significantly different from the strategy of other international funding agencies and quite comprehensive for achieving the goal of sustainable agriculture. Assisting for poverty reduction by way of promoting schemes for agricultural productivity improvement through irrigation is not only the motto but it integrates community based participatory approaches to support agricultural development like improving access to markets or the use of new production technologies, promote environmentally sustainable production activities, facilitates education about alternative routes for employment, gender issues, measures to improve income and livelihood through micro-finance; rural infrastructure upgradation, to improve access to markets and product distribution, participatory processes to empower the rural poor with core skills (such as producing local food products), while helping them to set up a business plan, obtain market information and comply with health measures. In fact, external assistance for mega projects also needs more careful planning at micro level, so that the intended benefits of the projects are realised on sustainable basis.

REFERENCES:

1. ADB (2004) Country Strategy and Program Update, 2005-2007, India, Asian Development Bank CSP: Ind 2004-16
2. Das, D.K (2005a) '*Participatory Irrigation Management - A Perspective from Pani Panchayat Programme in Orissa'* Proceedings of World Water Day 2005, Central Water Commission, Bhubaneswar, Govt. of India, pp.126-149.
3. Das, D.K (2005b) 'Irrigation Management Transfer to Farmers in Orissa: Experiences and Lessons' Proceedings of conference on Irrigation Management: Policies and Practices, European Commission and Govt. of Orissa, Bhubaneswar, 20-21 June 2005.
4. Das, D.K (2005c) 'Community Based Socio-Economic Development Planning in Irrigation Projects in India: Strategic Approaches in JBIC Assisted Projects; CSIRD Discussion Paper: 5/2005; Center for Studies in International Relations and Development (CSIRD) Kolkata.
5. Das, D.K (2005d) 'Decentralised Governance of Irrigation Infrastructure for Sustainable Agriculture. Seminar Paper Vol. IV; NIRD Foundation Day Seminar' Rural Development and Social Change; National Institute of Rural Development, Hyderabad, 9-10 Nov. 2005
6. Das, D.K, Mangaraj, B.K and Acharya, R.C (2003) '*Multi-Perspective Monitoring and Evaluation of PIM (Pani Panchayats) in Orissa: An Analytical Approach'* Proceedings of Tenth National Water Convention, Ministry of Water Resources, Govt. of India,
7. Das, D.K, Mangaraj, B.K and Acharya R.C (2004) *'Performance Monitoring of Irrigation Management Reform (Pani Panchayat) in Orissa: A Multi-perspective Approach'*, 45th Technical Annual, Institution Of Engineers (India), Orissa State Centre, pp-425-431.
8. DeBoer, K. and Pandey, A. 1997, 'India's Sleeping Giant: Food', *The McKinsey Quarterly*, vol. 1997, no. 1, pp. 82-96.
9. Govt. of India (2002) National Human Development Report 2001, Planning Commission, New Delhi
10. Grossmann, M. and Poston, M. 2003, 'Skill Needs and Policies for Agriculture-led Pro-poor Development'; Working Paper Number 112, *QEH Working Paper Series*
11. JBIC (2003a) Evaluation of ODA Loan Project, Upper Indravati Irrigation Project, India; Report on web site of. JBIC
12. JBIC (2003b) Ex-post Evaluation IV Follow-up Evaluation of Development Studies (Agricultural Irrigation) Report; web site of. JBIC
13. JBIC (2003d) Meta Analysis of Ex-Post Evaluation Reports by Country and Sector Country Review Report India Final Report

14. JBIC (2005a) Supporting Sustainable Economic and Social Development of India, A Country That Has the Largest Impoverished Population; News Release; NR/2004-76, March 31, 2005

15. Simmons, C. and Supri, S. 1999, 'Failing Financial and Training Institutions: The Marginalization of Rural Household Enterprises in the Indian Punjab', *Journal of Economic Issues*, vol. 33, no. 4, pp. 951-72.

16. UNDP (2003) Human Development Report 2003, 'Millenium Development Goals: A compact among nations to end human poverty', The Oxford University Press, New York.

17. White, S. 1999, Women's Employment in the Agro Food Processing Sector: South Asia and East Africa, Agha Khan Foundation Canada.

VOLUMETRIC PRICING OF IRRIGATION WATER IN INDIA: EXPERIENCES AND LESSONS LEARNED

S. A. Kulkarni[1]

ABSTRACT

Volumetric method of pricing irrigation water has always been advocated as the better approach to induce water savings by farmers. However, owing to seemingly technical and administrative complexities in adoption of the volumetric method - especially in large public canal irrigation systems, the area based pricing method is widespread in most countries. In India, during the last decade, there has been significant development in adoption of the volumetric supply and pricing through participatory irrigation management. Present paper provides a brief overview of international practices and the present status of irrigation water pricing and participatory irrigation management in India. A case study of volumetric allocation, supply and pricing adopted by a Water User Association (WUA) in the State of Maharashtra has been presented. The experiences and lessons learned from the case study and similar other WUAs have clearly demonstrated that a combination of volumetric supply and pricing at the entry point of a WUA command area and subsequent distribution and recovery on crop-area-season basis by the WUA can become successful. Although, the much perceived objective of achieving water savings due to the volumetric pricing was not directly realized, there prevails a win-win situation both to the government department staff and WUAs /farmers. For irrigation staff, this approach has minimized the efforts in area measurement and vigilance on the area irrigated by farmers, and billing of irrigation charges has become simpler. From farmers' side, as there is a full freedom of cropping pattern and the volumetric water charging system being transparent, they are willing to pay higher rates and use the available water efficiently by irrigating more area with same amount of water. Nevertheless, there is a vast scope to refine /upgrade the present system, especially in respect of increasing the accuracy and reliability of flow measurement. The concept of volumetric supply can gradually be introduced at individual farmer's level by roping in available technology and farmers' involvement. There is a particular need to strengthen the role of WUAs to equip them for the enhanced responsibilities which calls for a major capacity building exercise.

1- Director I, Central Office, International Commission on Irrigation and Drainage (ICID), New Delhi <icid@icid.org>

INTRODUCTION

There are many methods of assessing irrigation water prices in different countries across the world; most common being - area based, crop and area based, volumetric, and market based methods. Charging of water on volumetric basis has been considered as superior approach to overcome deficiencies of charging by area based method. The volumetric pricing approach is considered to be conducive to create an incentive for efficient allocation and use of irrigation water and has been advocated by the World Bank and other international donors. The countries employing volumetric pricing approach include Australia, England, France, Israel, Jordan, Mexico, Morocco, Spain, and USA. In California, about 80 % of the more than 100 irrigation districts have shifted to volumetric charging system since the past 20 years (Burt, 2006). In these irrigation districts, the land holdings are large and water is distributed mostly through pipe network up to farm head. In Philippines volumetric charging is practiced as a means of achieving simplicity of billing (Cornish et al., 2004).

There is a vast array of literature available on irrigation water pricing. Water pricing experiences across 22 countries for irrigation purposes have been presented by Dinar and Subramanian (1997). A literature survey on pricing of irrigation water was brought out by the World Bank (Johansson, 2000). The overview of worldwide experiences of water charging in irrigated agriculture is provided by Bosworth et al., (2002), Cornish and Perry (2003), and by Cornish et al., (2004).

In Morocco, the water charges range from US$ 0.02 to 0.06 / m^3 which correspond to about US$ 100 or more per hectare for typical field crops (Cornish and Perry, 2003). Perry (2001) reported volumetric water charges in Iran as US$ 0.004 /m^3, which amounted to US$ 30-40/ha for wheat, barley and maize and US$ 90/ha for rice. He found that if volumetric prices are to be used to induce farmers to invest in improved on-farm technology (e.g. sprinkler, micro irrigation) to save water, these water charges would have to exceed US$ 0.08/m^3 – a 20 fold increase – for the investment in on-farm water management to be profitable. It was thus observed that volumetric pricing in any form, in the absence of much higher water charges, will have very little impact on farmers' choice of crop or choice of irrigation technology. As per the recent report of the Working Group on Financing Water for Agriculture (WWC, 2006), irrigation charges at a level necessary to cover O & M costs tend to be too low to affect farmer's behavior and are useless as tool of water conservation. On the other hand, if the charges were raised to a level that would influence farmer's behavior, it would be politically unacceptable. Paradoxically, raising the price of canal irrigation water could induce farmers to extract more water from groundwater sources, which is highly subsidized (notably in India) through free electricity for pumps leading to overexploitation of aquifers.

Most water pricing literature has indicated that the extra cost of constructing flow measuring devices and related administration of measuring discharges, compilation and preparation of bills is often prohibitive, especially in large and spatially spread public irrigation system serving thousands of smallholders and thus the volumetric based charging system is not-worth-the-cost of its implementation. As a result, area based fixed rates are dominant in most irrigation systems.

PRICING OF IRRIGATION WATER IN INDIA

In India, pricing of irrigation water has been debated since long. Various committees and commissions have examined the issue from time to time and have given their recommendations. Irrigation commission (1972) recommended that the water rates should be 5% - 12% of the total value of farms produce, the lower percentage being applicable to food crops and higher for cash crops.

Vaidyanathan Committee (1992) recommended a two-part tariff comprising a fixed charge applicable to entire command area as a membership charge, a variable charge based on area irrigated to recover annual operation and maintenance (O & M) cost, and 1% interest on the capital cost. Full cost recovery was recommended to be the ultimate goal. To accomplish this goal the needed changes were to be brought out in phases, eventually leading to pricing on volumetric basis supported by improvement of existing systems, creations of autonomous, financially self-reliant entities at the system level with participatory management by users. Eventually, some of the recommendations have been implemented by a few State Governments. The volumetric pricing of irrigation water is one among others.

In India, all public irrigation systems are Government administered and there is no direct link between water charges and O & M cost. The water rates vary widely from State to State and are decided more as political decision. The water rates presently being charged are highly subsidized and are much less than even the recurring O & M expenses (CWC, 2004). In India, owing to its simplicity, charging of irrigation water on area basis is the most widespread practice. Considerations forming the basis for water charges on area basis include - source (surface water, groundwater), supply type (gravity, lift), season (rainy, winter and summer), type of crop (food grain, cash crops), duration of crop growing season (seasonal, two seasonal, and perennials), method of irrigation (drip, sprinkler), land classification (like wet and dry lands), and scale of the project (major, medium, and minor). In some States water charges are combined with land revenue while in some other electricity to pump groundwater for irrigation is provided free of cost. In some States there is no charging of water for irrigation purposes. In general, in India allocation for O & M are typically half or less of real O & M expenditure needs (CWC, 2004). The prevailing water charges range from about less than US$ 1 to $ 140 per hectare. Table 1 shows the water rates for paddy, wheat and sugarcane in canal command (flow irrigation) areas in major irrigating States of India.

Table 1. Water charges range (lowest and highest) for some crops in India

Sl. No.	State	Irrigation water rates (Rs /ha)		
		Paddy	Wheat	Sugarcane
1	Andhra Pradesh	247 – 494	----	247 – 494
2	Assam	281 – 751	----	222
3	Bihar	108 – 247	138 – 185	185 – 370
4	Gujarat	**701 – 825**	200 – 240	280 – 2750
5	Haryana	148	111 – 123	172 – 197
6	Jharkhand	108 – 217	138 – 185	370
7	Karnataka	247	148	988
8	Madhya Pradesh	200 – 494	200	741
9	Maharashtra	238	**476**	**6297**
10	Rajasthan	49 – 197	64 – 148	103 – 286
11	Tamil Nadu	37 – 49	----	49
12	Uttar Pradesh	40 – 287	128 – 287	99 – 474

PARTICIPATORY IRRIGATION MANAGEMENT (PIM) IN INDIA

The National Water Policy of India (MOWR, 2002) emphasizes that allocation of irrigation water should be done with due regard to equity, social justice and that the supply of water should be made on volumetric basis. Now many States have adopted Participatory Irrigation Management (PIM) approach, where irrigation water is supplied to the Water User Associations (WUAs). As per the Ministry of Water Resources (MOWR), the Govt. of India, more than 60,000 WUAs covering about 12 million hectares have been formed in the country (personal communication). States where PIM has been adopted on a significant scale are Andhra Pradesh, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Orissa and Tamil Nadu. However, excepting the States of Maharashtra and Gujarat, the volumetric allocation and supply is yet to be adopted in other States.

VOLUMETRIC PRICING IN MAHARASHTRA

Maharashtra State, situated in the south-west of India has semi-arid climate and irrigation is essential to obtain assured and reasonable crop yields. Of the total cultivable area of 22.4 million hectares, some 1.26 million ha are irrigated by canal (surface) water (inclusive of 0.44 million ha by wells in the command area) (WRD, GOM, 2006a). As a part of water sector reforms, special campaigns were taken up to promote PIM by formation of WUAs in the public canal irrigation schemes.

The first successful attempt of establishing a WUA in Mula project was made in Maharashtra in 1989. Since then the PIM movement has been spreading slowly but steadily in the State. At present, more than 1100 WUAs covering about 0.35 million hectares are fully functional (Damani et al., 2006). Beside this, more than 1500 WUAs covering 0.6 million ha were in pipeline. Figure 1 shows the growth of WUAs in Maharashtra.

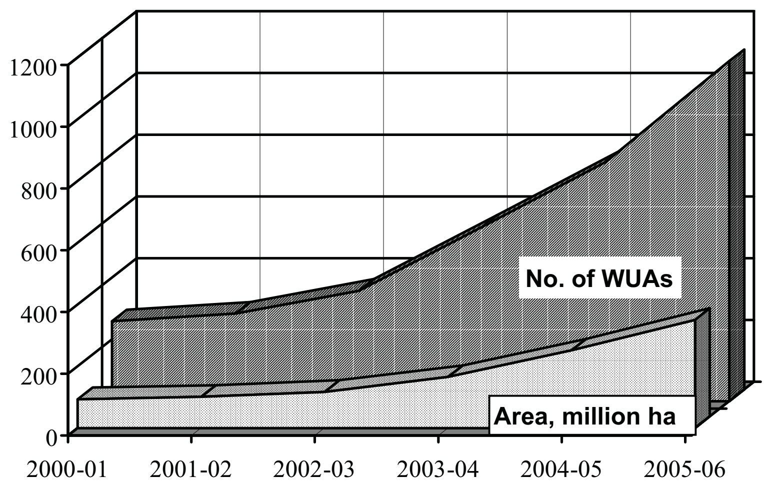


Figure 1. The growth of Water User Associations in Maharashtra State

Maharashtra is one of the pioneering States in initiating supply and pricing of irrigation water on volumetric basis. As per the Maharastra State Water Policy, 2003, Maharashtra Management of Irrigation Systems by Farmers (MMISF) Act 2005, and Maharashtra Water Resources Regulatory Authority (MWRRA) Act, 2005, it is mandatory to allocate water to WUAs on volumetric basis. In the public canal irrigation schemes, water is supplied to the WUA at the minor (tertiary canal) head (an entry point of the WUA's command area) and charged on volumetric basis. The WUA has the freedom to deliver water to its members either on crop-area or delivery time basis and also to determine rates to be paid by the members to the WUA. The farmers have freedom to grow crops of their choice and reuse the return groundwater (through percolation and seepage) through wells without any extra charge. Farmers generally make conjunctive use of canal and groundwater for irrigating their crops. Crops like vegetables and orchards which require irrigation at short intervals are often irrigated by groundwater, besides surface water made available during rotations. There is a provision that if water is not availed in a particular rotation or season, it can be saved / reserved and demanded in the next rotation or season.

In order to promote the concept of volumetric supply and pricing, capacity building and training of field level functionaries, and farmers is taken up on regular basis. Seminars and workshops with the active involvement of NGOs and experts are held to orient and explain the technical and socio-economic aspects of volumetric pricing to engineers as well as farmers.

FIXING OF VOLUMETRIC PRICING

Allocation of water volume (quota) on seasonal and area basis varies from project to project and decided on the basis of- (i) Live storage capacity of the reservoir (ii) Evaporation losses from the reservoir (iii) Commitments /reservations for irrigation and non-irrigation uses both at upstream and downstream (iv) Cropping pattern in different seasons, and (v) Conveyance losses in canal and distribution network.

In Maharashtra, the volumetric charges for bulk water supply have been so fixed that the assessment on the volumetric rate and the prevailing crop-area-season rate almost matches. The volumetric rates vary as per the season – low in monsoon (kharif) season and high in summer (hot weather) season. The present volumetric rates in the State are Rs. $47.6/10^3$ m^3 for kharif season (1 July to 14 October), Rs. $71.4/10^3$ m^3 for rabi season (15 October to 28 February), and Rs. $144.8/10^3$ m^3 for hot weather season (1 March to 30 June). These volumetric rates are applicable until the next revision of the crop area rates. A comparison of water rates on crop-area-season and volumetric basis is shown in table 2.

FLOW MEASURING DEVICES IN CANALS

In India, the tradition of flow measurement in canals is in vogue since more than a centaury, and the conventional measuring devices like Standing Wave Flume (SWF), Parshall Flumes, Orifices and V notches are generally used. In some States, the measuring devices are not constructed separately, but only the gauges .are installed in the canals. The discharges are then computed by using Manning's or other empirical formula.

In Maharashtra, in most of the irrigation projects, the discharge measurement data of main canals, branch canals /distributaries is routinely maintained. A SWF was installed on Mutha canal in 1928. Since then the SWF is normally provided on all canals and distribution system having discharging capacity more than 0.15 cumecs. Later in 1970s, under the World Bank and USAID assisted programmes, Parshall and Cut-Throat Flumes were introduced for measuring flow below 0.15 cumecs. Manuals and Standards on design and construction of measuring devices have been prepared by the Department. Irrigation engineers are trained in the subject at the State's Water and Land Management Institute (WALMI) on regular basis. A typical installation of a SWF on a minor in the Waghad project is shown in figure 2.

Table 2. Comparison of water rates on crop-area-season and volumetric basis (Adopted from Damani et al., 2006)

Season	Crops	Water rates on crop-area basis		Water rates on volumetric basis	
		(Rs./ha)	(US$ /ha)*	(Rs./10^3 m^3)	(US$ /10^3 m^3)*
Kharif	Millet	238	5.3	47.6	1.06
	Sorghum	238	5.3	47.6	1.06
	Peanut	724	16.0	47.6	1.06
	Rice- paddy	724	16.0	47.6	1.06
Rabi	Wheat	476	10.6	71.4	1.6
	Sorghum	357	8.0	71.4	1.6
	Gram	476	10.6	71.4	1.6
Two-seasonal	Kharif and Rabi crops (e.g. Cotton)	724	16.0	59.5	1.3
Hot weather	Peanut	1438	32.0	144	3.2
Perennial	Sugarcane	6297	140	87.7	1.9

* (1 US$ ≈ Rs. 45)

Figure 2. A view of a Standing Wave Flume in operation (left) and a gauge chamber (right)

VOLUMETRIC PRICING IN JAI JAGDAMBA WATER USER ASSOCIATION – A CASE STUDY

Waghad dam located in the north Maharashtra is one of the four dams that comprise the Upper Godavari Project. The dam was constructed in 1979 with a live storage capacity of its reservoir as 72 million cubic meters. Water is conveyed through two main canals viz., a 45 km long Right Bank Canal and a 15 km long Left Bank Canal. The culturable command area of the Waghad irrigation scheme is 9642 ha and the irrigable command is 6750 hectare. There are 24 WUAs covering the entire command area of the scheme. Recently, the entire project has been transferred to a Project Level Association (PLA) by forming a 'Federation of Water User Associations' under 'Maharashtra Management of Irrigation Systems by Farmers (MMISF) Act 2005'. Water is supplied to the PLA at the main canal head on volumetric basis, which is further distributed among WUAs as per their sanctioned quota. The water quota allocation for kharif and rabi season in the Waghad command has been worked out as 1360 cubic meter/ha and 1648 cubic meter/ha for kharif and rabi seasons, respectively (Belsare, personal communication).

Jai Jagdamba Water User Association is one of the 24 WUAs of the Waghad Irrigation scheme and was formed in 1997. The command area of the WUA is 338 ha and receives water from two minors (minor No. 16 and 17) and three direct outlets (19A, 20 and 21) of a distributary. There are 162 beneficiary farmers belonging to three near by villages. Originally, the Waghad system was planned and designed for supplying water only for two seasons (kharif, and rabi) and mostly for providing supplemental irrigation to cereal crops. The agreed upper limit of water volume (quota) allocated to the Jai Jagadamba WUA following the agreed norms is 166×10^3 m^3 for kharif season, and 356×10^3 m^3 for rabi season. However, the WUA has freedom to use any amount of water within the total allocated quota (522×10^3 m^3) during any season and also to grow crops as per farmers' preference. Subsequently, all farmers shifted to cash crops (sugarcane, grapevines, vegetables, and flowers) with food grain crops grown on small area. As per the provision, if the WUA saves from the allocated water quota of either kharif and/or rabi season, it is entitled to get the balance volume of water (after consideration of evaporation and other losses) for irrigating crops in the hot weather season. Generally, there is no demand for water in kharif season as rain water and groundwater are sufficient to satisfy crop water requirement. There are 176 open wells and 64 bore wells in the command area of the WUA. Conjunctive use of water is extensively practiced, meaning crops are irrigated both from canal water and groundwater. The WUA receives bulk water on volumetric basis as per the overall water quota allocation policy of the Waghad Project and subject to the actual storages in the reservoir. Individual members receive water as per their sanctioned area and schedule - prepared prior to each irrigation rotation by the WUA. Internal distribution of water, assessment and recovery of charges rests with the WUA. Members are charged on crop-area basis while the WUA pays to the Department on volumetric basis. Table 3 shows an abstract of area irrigated and water supplied to the WUA in each of the three rotations in the hot weather season- 2005-06.

Table 3. Crop wise area irrigated and water supplied in hot weather season (2005-06)

Crop	Area irrigated in rotation (Hectare)		
	1st (3 to 9 April 2006)	2nd (11 to 16 May 2006)	3rd (28 and 29 May 2006)
Grape Vines	32.7	39	11.6
Vegetables	11.8	11.20	1.3
Others	5.92	6.8	0.8
Sub total	50.42	57.0	13.7
Water supplied to the WUA (10^3 m^3)	102.6	113.4	27.1

A sample discharge measurement record of the minor 16 for the rotation 2 as maintained by the Water Resource Department and the WUA is shown in table 4.

Table 4. Record of gauge reading (H) and corresponding flow (Q) of the SWF at the minor 16 for the rotation 2

Date		Gauge reading at the hour									Average Volume	
		6	9	12	15	18	21	24	3	6	(Day-Cusecs)	(10^3 m^3)
11/5/2006	(H)	-	0.55	0.55	0.52	0.48	0.48	0.48	0.48	0.47		
	(Q)	-	7.15	7.15	6.45	5.81	5.81	5.81	5.81	5.62	4.91	12.2
12/5/206	(H)	0.47	0.47	0.46	0.46	0.52	0.58	0.58	0.58	0.58		
	(Q)	5.62	5.62	5.45	5.45	6.45	7.75	7.75	7.75	7.75	6.62	16.2
13/5/2006	(H)	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.52		
	(Q)	7.15	7.15	7.15	7.15	7.15	7.15	7.15	7.15	6.45	7	17.1
14/5/2006	(H)	0.58	0.55	0.46	0.42	0.38	0.55	0.6	0.58	0.58		
	(Q)	7.75	7.15	5.45	4.75	4.1	7.15	8.15	7.75	7.75	6.67	16.3
15/5/2006	(H)	0.58	0.62	0.48	0.42	0.44	0.55	0.48	0.42	0.42		
	(Q)	7.75	8.15	5.91	4.75	5.09	7.15	5.91	4.75	4.75	6.02	14.7
16/5/2006	(H)	0.42	0.4	0.34	0.32	0.45	0.2	-	-	-		
	(Q)	4.75	4.45	3.49	3.18	5.27	1.57	-	-	-	2.26	5.52
Total											33.48	82

The rotation and season wise volume of water supplied to the Jai Jagadamba WUA and corresponding area irrigated during the last five years (2001 to 2006) is shown in table 5.

Table 5. Season and rotation wise water supplied to the WUA and area irrigated

Year	Season	Irrigation rotation No.	Volume supplied to the WUA (10^3 m^3)	Area Irrigated (ha)	Av. water withdrawal at the minor head (m^3/ha)
2005-06	Rabi	1	65.1	31.8	2047
		2	84	38	2211
		3	117.8	55.5	2123
		4	83.5	40.1	2082
	Hot Weather	1	102.6	50.42	2035
		2	113.4	57	1989
		3	27.1	13.7	1978
2004-05	Rabi	1	42.29	18.9	2238
		2	86.1	38.6	2231
		3	110.8	52.6	2106
	Hot Weather	1	115.3	56.1	2055
		2	96.5	47.3	2040
		3	26.7	11.34	2354
2003-04	Rabi	1	92.3	43.1	2142
		2	112.2	53.7	2089
	Hot Weather	1	97.6	46.9	2081
		2	68.8	33.2	2072
2002-03	Rabi	1	136.5	59.1	2310
		2	142.3	74.2	1918
		3	87	45.3	1921
	Hot Weather	1	120	57.1	2102
2001-02	Rabi	1	78.3	35.9	2181
		2	124	66.5	1865
	Hot Weather	1	120.4	59	2041

As can be seen from the table 5 that the area irrigated in each rotation varied from 11 ha to 74 ha during the last five years. On an average about 2000 cubic meter was used to irrigate a hectare (at minor head). As mentioned elsewhere, conjunctive use of surface and groundwater is extensively practiced in the command of the Jai Jagadamba WUA and in the hot weather season about 166 hectares were irrigated by wells, indicating significant reuse of recharged water. Some farmers have constructed farm ponds to store rain water and in some cases irrigation water. Grapevines are grown on about 130 hectares and almost all the area is irrigated by drip system. The computation of water charges for the hot weather season (2005-06) to be paid by the WUA to the Water Resources Department is shown in table 6.

Table 6. Assessment of water charges by the Water Resources Department to the WUA for the hot weather season 2005-06

Total water delivered to the WUA (10^3 m^3)	Water rate (Rs./10^3 m^3)	Amount (Rs.)	Local cess (20% of the amount in column 3, Rs.)	Total water charges to be paid by the WUA (Rs.)
(1)	(2)	(3)	(4)	(5)
243.1	144.8	35,200.90	7040.2	42,241.00 (US$ 939)

The Water Resources Department gives a rebate of 20% on the total charges to WUAs as a grant and a further rebate of 5% is given if the WUA pays the water charges by 15 October of that year. The Jai Jagadamba WUA charges Rs. 750 /ha for all crops in the rabi season and Rs. 1075 /ha /rotation for all crops in hot weather season to its members. The amount charged for the hot weather season (2005-06) was Rs 130,203 thus leaving profit of Rs .87,962 (inclusive of the rebates as above) to the WUA.

EXPERIENCES AND LESSONS LEARNED

The volumetric pricing has been proved as a win-win approach both to Water Resources Department and WUAs /farmers. Generally, there has been a positive attitudinal shift towards volumetric pricing among Department personnel –from the top administration to the lower level field staff. Some experiences and lessons learned in implementation of the volumetric supply and pricing in Maharashtra state are briefed as follows:

WATER RESOURCES DEPARTMENT

Initially, engineers had a feeling that the farmers, being illiterate would not understand the discharge measurement procedure and hence it would be difficult to implement the volumetric supply. Many field engineers used to complain that the farmers tend to tamper /break the measuring devices and hence there is no point in constructing /repairing them. Some field officers had an apprehension that once the volumetric supply system is introduced they will be fully accountable in delivering the committed quota and flexibility in supply to the WUAs.

As accounting of water is in-built in the volumetric supply system, assessing water charges and preparing bills became simple and time /cost saving. As the scheduling of water, maintenance of the system below the minor head and recovery of water charges from individual farmers is taken care by the WUAs, there has been a decline in number of complains from farmers. The tedious task of measurement of irrigated areas of every farmer in each rotation has been curtailed. Both, the Department and the WUAs jointly keep record of flow measurement at the minor head. The assessment and billing can be done quickly without waiting for measurement /verification of actual irrigated areas. As the measurement of discharges at different points of the canal network become mandatory, it provides factual information on the extent of conveyance losses in the system.

WUAS AND FARMERS

WUAs / farmers have incentive to apply water efficiently and water thus saved can be used to irrigate additional area and /or for the next season. Tail end farmers who were earlier deprived of getting reliable and adequate water supply are now getting assured and equitable supply. The WUAs have developed a confidence as they know about the quantum of water being used by them in a transparent manner. The water charges are payable for an actual volume received at the minor head. The recharge due to seepage /percolation of water in the command area of the project is available for reuse, free of charge.

Some farmers feel that the measuring devices obstruct /reduce the flows due to constriction /hump and hence they tamper or break the measuring device. When explained properly with field demonstration that they are required to pay only for actual quantity of water supplied /received by them, most of the farmers /WUAs were convinced and accepted the volumetric supply. Once the farmers understand the full implications of measurement of discharge, they insist on charging water on volumetric basis, instead of crop-area basis. This has created a sort of competition among WUAs for irrigating more and more area with the same volume of water.

REGULATORY PROVISIONS

To adopt volumetric supply, a regulatory framework for allocating water among farmers, acts, rules and procedures defining rights and responsibilities, priorities in case of shortage or excess supplies, penalties for breach of rules greatly help empower both irrigation officials and WUAs.

CAPACITY BUILDING AND TRAINING

Capacity building and training of the field staff of the Water Resource Department, office bearers, farmers and employees of the WUAs in understanding the volumetric pricing, measurement of discharge, calculation of volumes and preparation of bills, maintenance of flow measuring devices, crop water requirement, efficient on-farm irrigation methods, measuring losses in canals and water courses will go a long way in building confidence and competence among them.

FLOW MEASURING STRUCTURES

Some common deficiencies in construction and maintenance of measuring devices as observed are as follows:

Construction: The throat width of the flumes is altered during or after the construction due to application of a cement plaster layer. The gauge chamber is not properly constructed. The gauge sill levels are not connected to the hump or sills of the measuring device i.e. the zero level of the gauge does not tally with hump level. The distance of the gauge from the throat sill is not kept as per design. The pipe connecting the canal to the gauge chamber is either choked or provided with higher diameter than the design or at times the pipe is not provided at all. The fluming on upstream and down streamside is sometime not done with care and as per the geometrics of the device. In some cases the measuring structure is installed at incorrect location where required approach conditions do not prevail.

Operation and Maintenance: Measuring devices are not properly calibrated. Most of the flumes work under submergence condition. Gauge chambers are filled with debris and are not maintained on regular basis. Gauges are either damaged or not painted regularly. In case of chambers in deep cutting, the stairs /steps to go down for gauge reading are damaged. The sills /humps of measuring structures are generally broken or damaged. The downstream section is rough, filled with debris, which obstructs the formation of a standing wave or jump.

WAY FORWARD

Volumetric supply and pricing of irrigation water in India is still at experimental stage and has to go a long way before it becomes a widely accepted and an integral component of WUA’s operation. The case study has amply demonstrated that farmers are willing to pay higher water charges provided the supplies are reliable, flexible, equitable and there is a transparency in the billing system. In the Waghad project, a few WUAs have gone one step ahead by practicing internal distribution of water on hourly basis instead of crop-area basis (proxy volumetric approach). Nevertheless, the political will, quality of service, and leadership are the *buzzwords* to make it happen. There is a need to make the flow measurements more accurate, reliable and the structures more robust. The flow measuring device may be equipped with an automatic water level recorder /totalizer to account for fluctuating flow rates and convert those into volumes. Deficiencies in the construction and maintenance of the measuring structures need to be removed. Some innovative flow measuring devices may be tried. There is a need to provide water level regulating structures in the canal network to maintain stable flows at the measuring points. Capacity building and training of all concerned – Department personnel and farmers should continue. With the given scenario, one can hope of using volumetric water pricing as a tool to bring about water savings in reality.

ACKNOWLEDGEMENT

The Author is grateful to Mr. M. Gopalakrishnan, Secretary General, ICID for his encouragement in preparation of the paper. Thanks are due to Dr. Sanjay Belsare, Executive Engineer and Er. Avinash Lokhande, Section Officer, Palkhed Irrigation Division, Nashik, Maharashtra for providing information and data related to Jai Jagadamba Water User Association.

REFERENCES

1. Bosworth B., G. Cornish, C. Perry, F. van Steenbergen (2002): Water Charging in Irrigated Agriculture – Lessons from the literature, DFID, HR Wallingford, Report OD 145

2. Cornish G. B., Bosworth, C. Perry, and J. Burke (2004): Water Charging in Irrigated Agriculture – An analysis of international experience, FAO Report 28

3. Central Water Commission (2004): Pricing of Water in Public System in India, Information Systems Organisation, Information Technology Directorate, Water Planning & Projects Wing, Central Water Commission, New Delhi

4. Belsare S. M., Executive Engineer, Palkhed Irrigation Division, Nashik, Maharashtra (personal communication)

5. Damani R .L, Purandare P. V., Purandare V. P., and Ingle A. P. (2006): Volumetric Supply and Pricing of Irrigation water: Scenario in Maharashtra, Paper presented at the Workshop on Volumetric supply and Pricing of Canal Water, December 2006, SOPPECOM, Pune, Maharashtra, India

6. Dinar A., and A. Subramanian (1997): Water Pricing Experiences – An International Perspective, World Bank Technical Paper No. 386

7. Johansson R. C. (2000): Pricing Irrigation Water – A literature Survey, Policy Research Working Paper 2449, The World Bank

8. Ministry of Water Resources (2002): National Water Policy, Ministry of Water Resources, Govt. of India, <http://wrmin.nic.in/nwp2002.pdf>.

9. Perry, C. J. (2001): Charging for Irrigation Water: the Issues and Options with a Case Study from Iran, Research Report 52, IWMI, Colombo

10. Vaidyanathan, A. (1992): Report of the Committee on Pricing of Irrigation Water, Planning Commission, Govt. of India, New Delhi

11. Water and Land Management Institute (2004): National Workshop on Participatory Irrigation Management (PIM) and Volumetric Measurement, 2-3 July 2004, Aurangabad, Maharashtra, India.

12. Water Resources Department (2006a): Report on Water Audit of Irrigation Projects in Maharashtra, Government of Maharashtra, India

13. Water Resources Department (2006b): Report on Benchmarking of Irrigation Projects in Maharashtra, Government of Maharahstra, India

14. World Water Council (2006): Financing Water For Agriculture, Working Group on Financing Water for Agriculture, Progress Report No. 1, <www.worldwatercouncil.org>

PARTICIPATING THE FARMERS ON OPERATION AND MAINTENANCE OF THE IRRIGATION NETWORKS SYSTEM IN CENTRAL JAVA AND WEST NUSA TENGGARA PROVINCES

Mohd. Ali Fulazzaky[1] and Slamet Imam Wahyudi[2]

ABSTRACT

According to the Law No. 7/2004 on water resources, the irrigation networks management in Indonesia consists: the feasibility, environmental impact and masterplan studies; construction step; operation and maintenance phase as well as the monitoring and evaluation. Implementing the irrigation management especially in the paddy field areas which needed a huge water consumption and request of involving the stakeholders for each step of the management processes. Therefore, the national policy also as mentioned in the Government Regulation No. 20/2006 declared that the central and local governments recognize the role of the water user associations (WUAs) to carry out the irrigation networks system management based on farmers' participation approach.

This paper elaborates several researches for analysis and evaluation of the farmers' participation on operation and maintenance of the irrigation networks system in two provinces in Indonesia: Central Java and West Nusa Tenggara. The methodology of researches is respectively following the several steps i.e examining the population survey of the defined sampling locations, distributing the questionnaires and collecting the feedback responses of the farmers, and collecting the other relevant data as well as analyzing the validated data and evaluating the farmers' participation levels. The research is also conducting the secondary data of the existing studies, including in the Yogyakarta special province region.

The appreciation of the farmers' participation assess through the role of WUAs at the planning, performing, and evaluating processes as the parts of operation and maintenance of the irrigation networks system management and representing the presence or absence as well as the aptitude of the farmers in the meetings and supporting the examination of the records related in the locations of study.

This research giving the general responses of the farmers' participation at the planning and performing processes respectively as indicating the scores of 2.77 and 2.80 and classifying the moderate categories as well as at the evaluating process as indicating the

1- Water and Wastewater Senior Expert: Indonesian Ministry of Public Works, Jakarta – Indonesia and Lecturer at the UTHM Johor – Malaysia, email: fulazzaky@yahoo.com
2- Lecturer and Researcher et the Sultan Agung Islamic University, Semarang – Indonesia, email: siwahyudi@yahoo.com

score of 3.2 and classifying the high category. A general remark of the farmers' response on operation and maintenance of the irrigation networks system management in two provinces can be summarized as following: 42% of farmers is categorized as high participation, 16% as moderate participation, 32% as low participation and 10% as very low participation.
Key words: farmers' participation, irrigation network system, operation and maintenance

INTRODUCTION

The irrigation networks system management in Indonesia consists: the feasibility and environmental assessment impact studies; masterplan and detail plan preparations; construction step; and monitoring and evaluation phases as well as the operation and maintenance. Especially, the operation and maintenance phases have to be very close related to the irrigated agricultural field activities which needed a huge water consumption and involving the participation of the farmers as an important stakeholders. As highlighted in the government regulation and other national policies, one side, the farmer's participation on the irrigation management is being in order targeting the reduction of the annual government budget and, the other side, increasing the sense of belonging of the farmers and with care handling the maintenance of the irrigation network infrastructures.

One of the oldest farmers' participation through the WUA's organization in Indonesia is known as the "*Subak"* system in Bali island. The Subak is a traditional irrigation management institution of the irrigation networks system and founding as a socio-religious agricultural communities, it has been being more than one thousand year ago. The institution of the Subak system is a simple organization and corresponding the irrigated paddy field areas. In general, the system consists: *Pekaseh* (Chairman), *Petajuh* (Vice Chairman), *Penyarikan* (Secretary), *Juru Raksa* (Treasurer) and *Juru Arah* (Messenger). In general cases, the Subak communities meetings have to be assigned an agreement of irrigated water allocations and food productivity targets, especially for increasing the annual rice production (Sutawan, 1995).

According to the Law No. 7/2004 on water resources as highlighted in the Article 84, that the farmers have to be an equal opportunity taking part in the water resources management process i.e in the studies, planning, construction, operation and maintenance steps as well as in the monitoring and evaluation of the water resources management activities.

In the Government Regulation No. 20/2006 related to realization of the irrigation management in Indonesia, the government admits the farmer's participation through the role of the WUAs as the formal institutions to carry out the irrigation networks system management, i.e. planning, construction, rehabilitation, and operation and maintenance, as well as financing the irrigation networks system. It seems that the newly government policy has a good relevancy with the classic statement: "every body has a tendency to carry out all of the activities when he has to be participating in each step of management and decision making processes" (Davies, 1982).

According to the government regulation and policy also as mentioned in the Ministry of Home Affairs Decree No. 50/2001 and confirming the existing relevant studies such as the study on water resources management program that has been executed under the Water Resources Sector Capacity Building Project, the WUA's participation on operation and maintenance of the irrigation network system representing by participating the farmers at the planning, performing and evaluating processes.

OBJECTIVES

This paper synthesizes several studies by exploiting the thesis of the students of civil engineering master of sciences program from both the Sultan Agung Islamic University and Gadjah Mada University and mainly based on the researches which have been carried out for analyzing the operation and maintenance performance of the irrigation networks system in Central Java and West Nusa Tenggara provinces, with the objectives of:

- understanding and describing the farmers' participation for operation and maintenance of the irrigation networks system management;
- defining the farmers' participation levels at the planning, performing and evaluating processes of operation and maintenance performance of the irrigation networks system; and
- assessing the farmers' participation impact on the planning, performing and evaluating processes of operation and maintenance of the irrigation networks system management.

The recommendations of each research have been contributed to the local governments as well as to the related WUAs as a supporting input for the decision making process at the policy and operational levels and improving the operation and maintenance performance of the irrigation networks system – especially in order to increase the participation of farmers located in two provinces: Central Java and West Nusa Tenggara, the points of view as operators and also in the same time as investors under the framework of the national food security program.

SCOPES AND LOCATIONS

The substances of this paper based on the researches in two provinces i.e Central Java and West Nusa Tenggara are only limited on the farmers' participation at the planning, performing and evaluating processes of the operation and maintenance phases of the irrigation networks system management and also supporting the existing other relevant researches.

The locations of study consist: the irrigation networks system management in Purworejo, Banyumas, Kendal and Kudus districts in Central Java province and irrigation networks system management in Sumbawa Besar and West Lombok districts in West Nusa Tenggara province, as showing in the map of the Figure 1. For completing the transcription being supported by the additional information coming from the researches of the farmers' participation on irrigation and sustainable infrastructures management located in Gunung Kidul and Sleman districts – Yogyakarta special province.

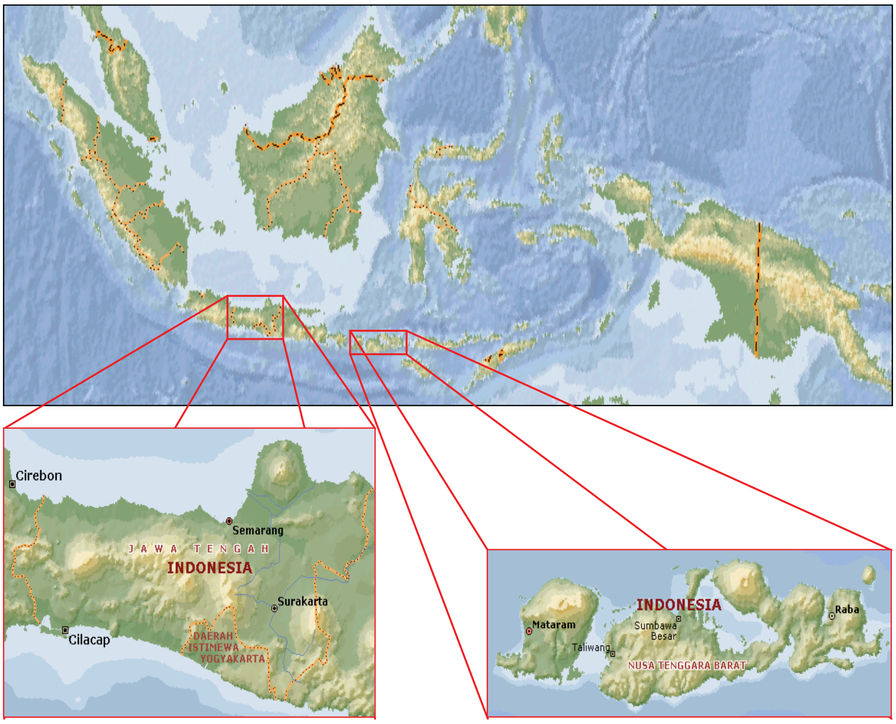


Figure 1. Central Java and West Nusa Tenggara provinces, the locations of study of the irrigation networks system management

METHODOLOGY

The procedure of the researches was systematically conducting the chronological experimentation stages i.e defining the locations, surveying the population and mapping, preparing the questionnaires, distributing the questionnaires and data collection as well as analyzing the data and evaluation.

Analyzing the farmers' participation levels at the planning, performing and evaluating processes of operation and maintenance of the irrigation networks system management, as following:

- Participating the farmers at the planning process indicated by monitoring the physical presence of the farmers in the meetings, contributing the ideas in the discussions, adopting the documents for the operation and maintenance plans, proposing the water allocation for irrigation purposes, proposing the plantation pattern proposal, and controlling the irrigation scheme which required for maintenance;
- Participating the farmers at the performing process indicated by cooperating between the farmers and the construction service providers, involving the farmers for the maintenance works, involving the farmer in the projects hand-over process, implementing the water user payment policy for the farmers, and supporting the operational of the water gates by the farmers; and
- Participating the farmers on the evaluating process indicated by reporting the illegal water uses by the farmers, reporting the destruction of irrigation

infrastructures by the farmers, reporting the conflicts of water uses and it solutions by the farmers, number of farmers as member of WUA and following the trainings, meetings and socialization programs that initiated both by the governments or NGOs.

The responses coming from the farmers were collected by the researchers based on distributed questionnaires for the random sampling areas and sampling clusters. Wherein, the sampling areas were selected a number locations of the irrigation networks system i.e four locations in Central Java and two locations in West Nusa Tenggara provinces and for the sampling clusters, the responses were collected from both the WUA's organizers and members.

The data analysis and evaluation resulting the farmers' participation levels have been carried out by applying the criteria consist of 5 participation levels as showed in Table I (Arikunto, 1992 and Sugiono, 2002). The responses of the farmers' participation were coming from 1,000 respondents and classified into five categories, as: very high; high; moderate, low; and very low.

Table I. Criteria of the farmers' participation level

No	Score range value based on standard deviation	Farmers' participation score	Category
1	mean + 1,5 SD to mean + 2,5 SD	>4 to 5	very high
2	mean + 0,5 SD to mean + 1,5 SD	>3 to 4	high
3	mean - 0,5 SD to mean + 0,5 SD	>2 to 3	moderate
4	mean - 1,5 SD to mean - 0,5 SD	>1 to 2	low
5	mean - 2,5 SD to mean - 1,5 SD	up to1	very low

Note: mean is average score and SD is standard deviation

PARTICIPATING THE FARMERS AT THE PLANNING PROCESS

A number of researches with different variables and points of view concerning the correlation between farmers' participation and irrigation management performance has been studied in several region in Indonesia. The researches of the farmers' participation on irrigation and sustainable infrastructures management located in Gunung Kidul and Playen water district in Sleman – Yogyakarta Special Province have been reported that the leadership and communication factors as well as the ecological and social-economic factors affected the farmers' participation level and influencing the sustainability of the irrigation networks system management (Sudaryanto, 2006).

The researches giving the general response of the farmers' participation at the planning process as indicating the score of 2.77 and classifying the moderate category, with the detail responses of the farmers are: 43 % of high; 5 % of moderate; 38 % of low; and 14

% of very low categories, as showed in Figure 2. An enthusiasm of the farmers for participation at the planning process is important taking account to consider and sharing their aspiration for achieving the rightful and proportional water allocation entire the river basin catchment area.

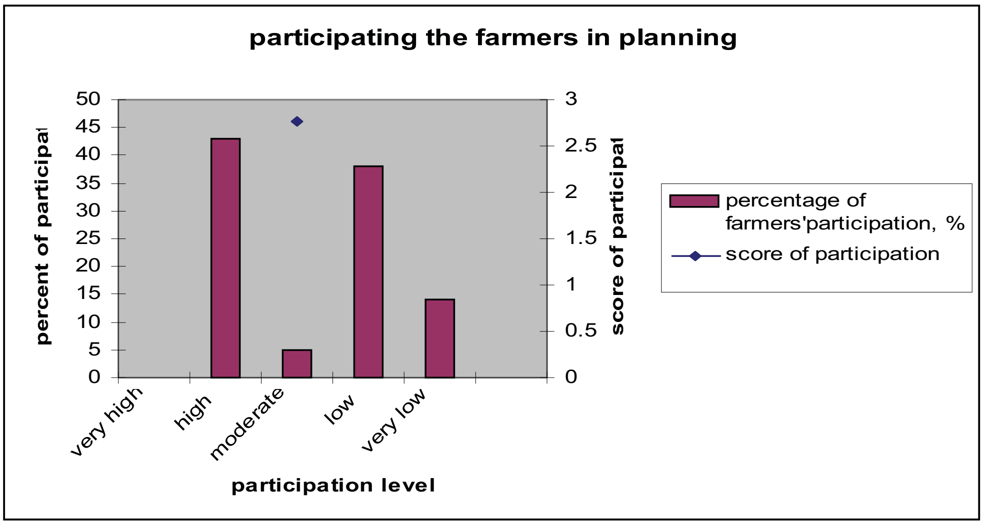


Figure 2. Profile of participating the farmers at the planning process

PARTICIPATING THE FARMERS AT THE PERFORMING PROCESS

Participating the farmers through the related WUAs for construction of the simple infrastructures giving a good participative model for maintaining after construction the public investments both constructed by the local and central governments, whereby the farmers' participation is kindly to carry out maintenance of the simple infrastructures. The important factors were hereby remarked under influence of the role of the technical assistants and the guidance from the government direction as well as the educational level of the farmers (Purwadi, 2003).

The general response of the farmers for participation studied at the performing process of operation and maintenance indicating the score of 2.80 and classifying the moderate category, with the detail responses of the farmers are: 35 % of high; 15 % of moderate; 45 % of low; and 5 % of very low categories, as showed in Figure 3. By analyzing the farmers' response of the studies which was carried out in the starting period of water resources reform, it could be optimistic predicted that will be increasing for the next years to come and, relevant with the law and government policies, participating the stakeholders will be making as an urgent request in the all of irrigation activities in Indonesia for the next time.

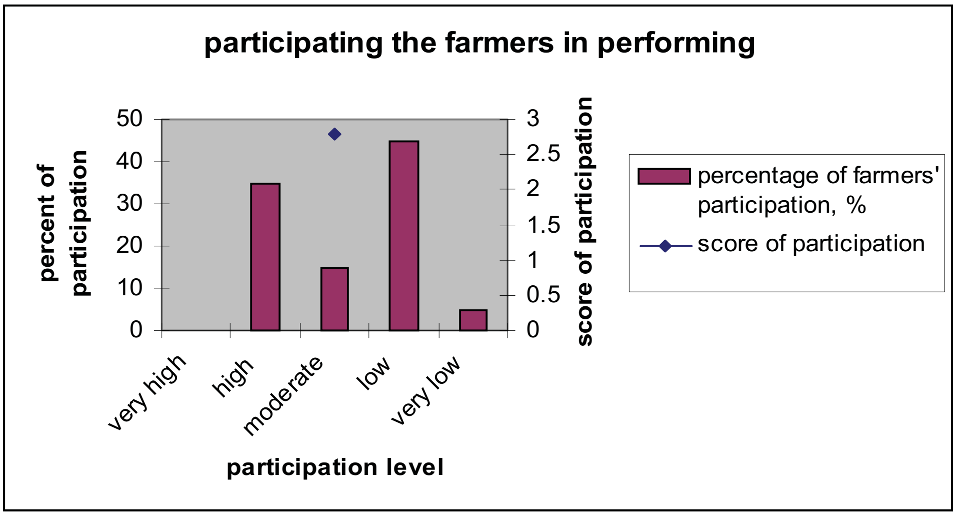


Figure 3. Profile of participating the farmers at the performing process

The participation of the WUAs for the routine and periodic maintenances as well as the operational activities and irrigation financing has been reported as a good image in Purworejo district – Central Java (Yuliani, 2003) and participating the farmers for implementation of the water rights, according the Law No. 7/2004, has been analyzed for the irrigation networks system management that was reported around 80 % of the farmers agreed with the water right principles and participating the farmers for water retribution fee was really remarked yield up to 45% (Istianah, 2005).

PARTICIPATING THE FARMERS AT THE EVALUATING PROCESS

The prospects of irrigation management hand-over confirming the national policy as highlighted in the Law No. 7/2004 and the Government Regulation No. 20/2006 to carry out taking over the responsibility of the irrigation management from the local government to the WUA's authority have been studied at the Mamak irrigation district in Sumbawa – West Nusa Tenggara. It was reported that the capability of the farmers for irrigation networks system management mainly depending the WUA's institution performance and then following the irrigation services management; agro-business climate condition; irrigation networks system condition; and conflicts resolution management (Wirawan, 2003).

The performance of operation and maintenance of the irrigation networks system has been analyzed in Kendal – Central Java. The technical factors i.e the accuracy of equipments for measuring the stream's flow; physical condition of the irrigation networks system; and illegal irrigation water losses as well as the non-technical factors i.e decentralization autonomous policy; unmatched plantation patterns; lack of the guidance from the local government; and low level of farmers' participation on operation and maintenance activities of the irrigation networks system clearly influenced to irrigated field management (Sunaryono, 2004).

The general response of the farmers for participation at the evaluating process as reported in these researches indicating the score 3.20 and classifying the high category, with the detail responses of the farmers are: 47 % of high; 29 % of moderate; 13 % of low; and 11 % of very low categories, as showed in Figure 4. As showing by high appreciation of the farmers, it can be recommended that improving the participation of the farmers as principal stakeholders at the evaluating process for certain locations of low interest should be considered in the local government policy for the years to come.

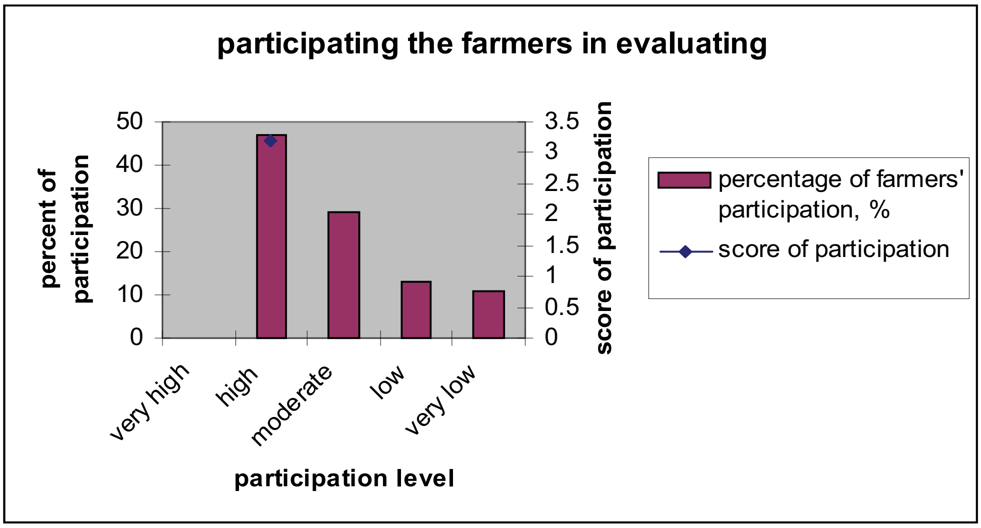


Figure 4. Profile of participating the farmers at the evaluating process

PARTICIPATING THE FARMERS ON OPERATION AND MAINTENANCE OF THE IRRIGATION NETWORKS SYSTEM

A research of the farmers' participation level at the upper Progo river basin in Central Java has been reported the different characteristics of each steps of operation and maintenance activities. Participating the farmers for the steps of the decision making and planning processes was monitored dominating the WUA's organizers, while the participation of the members of WUA was being passive. For performing step, it was observed a nice proportional correlation between the ownership of the land paddy areas and farmers' participation level. According to the existing research, the farmers who have more the land areas participate more active on all of operation and maintenance activities of the irrigation networks system (Mulyani, 1996).

According to this synthetic research, the total general response of the farmers for participation on the operation and maintenance activities of the irrigation networks system management can be optimistic classified by the moderate category, with the analyzed detail responses of the farmers' participation at the planning, performing and evaluating processes are: 41.7 % of high; 16.3 % of moderate; 32 % of low; and 10 % of very low categories, as showed in Figure 5. A good response of the farmers on operation and maintenance processes of the irrigation networks system management is important to consider the participation of them for other activities of water resources management due to a huge surface water consumption of the irrigated paddy field land, such as in the water resources conservation program, the river basin water resources planning, the water quality management and pollution control program, etc.

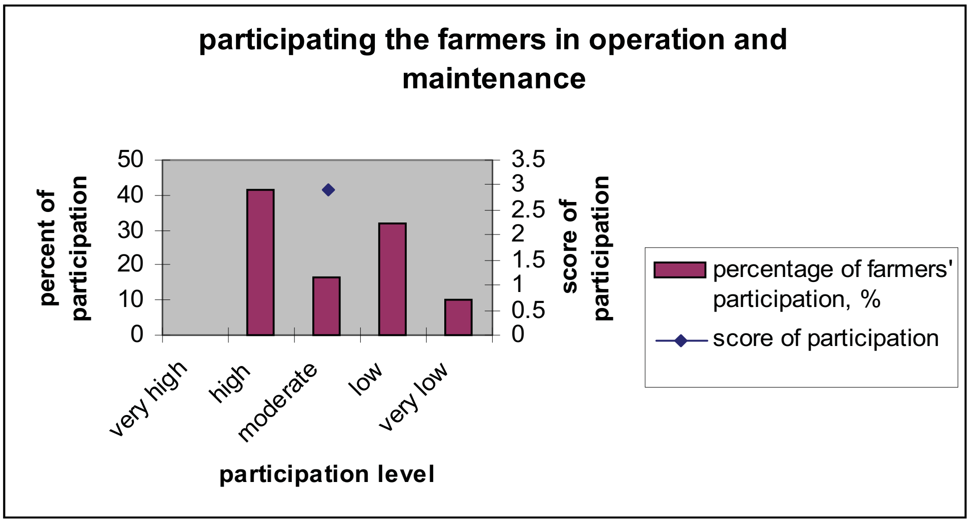


Figure 5. Profile of participating the farmers on operation and maintenance of the irrigation networks system

CORRELATION BETWEEN FARMERS' PARTICIPATION AND OPERATION AND MAINTENANCE PERFORMANCE OF THE IRRIGATION NETWORK SYSTEM MANAGEMENT

Carrying out the scoring the data of the farmers' participation at the planning, performing and evaluating processes. It is possible to be analyzed the performance of operation and maintenance of the irrigation networks system management both in Central Java and West Nusa Tenggara. And assessing the correlation between the farmers' participation and the operation and maintenance performance in this research, by following the F-test and supporting the SPSS-11's software. Analyzing the value of the F-test giving the $F_{calculate}$ is 51.56 and F_{theory} is 2.71, there for $F_{calculate} >> F_{theory}$. It can be concluded that the farmers' participation at the planning, performing and evaluating processes has a positive impact on the operation and maintenance performance. Regarding this reason, the participation of farmers really increases the performance of the agricultural management at the irrigated paddy field in Indonesia.

CONCLUDING REMARKS

For ensuring the national food security, the Government of the Republic of Indonesia desires for increasing the food production to achieve the national rice self-sufficiency and the efforts are relevant with several literatures as remarked by the popular slogan of: "more crops per drop" as an international statement for balancing between the food and the world population growth. Implementing the on going water resources reform policy remarked by issuing the Law No. 7/2004. Herein, the farmers' participation becomes the important issues for improving the performance of the irrigation management – especially on operation and maintenance of the irrigation networks system.

Several researches have been carried out for different locations in Indonesia for evaluation the farmers' participation on operation and maintenance of the irrigation networks system by different analysis methods and clearly concluding the positive impact. This synthetic research was carry out at six water districts in two provinces i.e Central Java and West Nusa tenggara, the results also showing that a good correlation between the farmers' participation and the performance of operation and maintenance of the irrigation networks system in Indonesia.

REFERENCES

1. Sutawan, N., 1995.; Water management in Bali island by Subak system, National Seminar on Water Resources Management, Udayana University, Denpasar – Bali, Indonesia
2. Davies, A., 1998.; A model for planning and conducting activities, The training of adult and community educators, Australian Association of Adult Education, Canberra, Australia
3. Arikunto, S., 1992.; Prosedur penelitian – Suatu pendekatan praktek, PT. Bina Aksara, Jakarta, Indonesia
4. Sugiono., 2002.; Statistik untuk penelitian, Affabeta, Bandung, Indonesia
5. Sudaryanto, E., 2006.; Effect of the farmer participatory on the operation and maintenance performances of the irrigation scheme management, Thesis, Civil Engineering Magister of Sciences Program, Sultan Agung Islamic University, Semarang, Indonesia
6. Purwadi., 2003.; Analysis of role of the construction supervisor and community officer on the participatory construction method implemented by the water users associations (WUAs), Thesis, Civil Engineering Master of Sciences Program, Sultan Agung Islamic University, Semarang, Indonesia
7. Yuliani, T., 2003.; Kajian parameter operasional dan pemeliharaan partisipatif untuk Perkumpulan Petani Pemakai Air (P3A) – Studi kasus daerah irigasi Boro – Kabupaten Purworejo, Thesis, Civil Engineering Master of Sciences Program, Sultan Agung Islamic University, Semarang, Indonesia
8. Istianah., 2005.; Kajian pelaksanaan Undang-Undang No 7 Tahun 2004 berkaitan dengan hak guna air di Kecamatan Undaan – Kabupaten Kudus, Thesis, Civil Engineering Master of Sciences Program, Sultan Agung Islamic University, Semarang, Indonesia
9. Wirawan., 2003.; Kajian prospek pelaksanaan kebijakan penyerahan kewenangan pengelolaan irigasi kepada P3A – Studi kasus daerah irigasi Mamak – Kabupaten Sumbawa, Thesis, Post-graduate Program – Gadjah Mada University – Yogyakarta, Indonesia
10. Sunaryono, C., 2004.; Faktor-faktor yang berpengaruh terhadap kinerja jaringan irigasi Sojomerto – Kabupaten Kendal, Thesis, Civil Engineering Magister of Sciences Program, Sultan Agung Islamic University, Semarang, Indonesia
11. Mulyani, S., 1996, Faktor-faktor yang mempengaruhi derajat partisipasi P3A pada implementasi program penyerahan irigasi kecil (PIK) pada Cabang Dinas Progo Hulu – Kabupaten Magelang, Thesis, Post-graduate Program – Gadjah Mada University – Yogyakarta, Indonesia

TESTING P+PR CONTROL SYSTEM FOR PARTICIPATION OF WATER USERS IN DELIVERY MANAGEMENT

Mohammad Javad Monem[1], Mohammad Sadegh kiapasha[2]

ABSTRACT

Facing water shortage and increasing water demand, it is necessary to consume limited water resource in an optimal fashion. In agricultural sector as the biggest consumer of water, due to low performance of irrigation networks improving, water delivery systems and its performance with participation of water users and applying improved control system is a must. For this purpose in recent decades several automatic control Systems including P+PR system, for flow management in irrigation networks are introduced. Applications of these techniques provide a situation that water users play a direct role in water delivery with high flexibility. After introducing any automatic control system, their application in irrigation canals, requires testing of their performance in relation with other structures. Considering unsteady behavior of the flow in irrigation canals, using hydrodynamic models is a regular approach for testing performance of control systems. For this purpose international test cases including two types of canals, with specific operational instructions are introduced by American Society of Civil Engineering (ASCE). In this paper ICSS hydrodynamic model is applied on ASCE standard canal no. two to test the global performance of P+PR downstream automatic control system. After calibration of numerical coefficients of control system, the operational scenarios are applied, and performance indicators such as MAE and IAE which represent maximum and average depth deviation respectively and SRT which indicates response time of control system are determined. In addition to the performance indicators, depth, Flow and gate adjustments variations are depicted and analyzed. The results show that average depth deviations are in the range of 0.001 to 0.014 % and maximum depth deviations are in the range of 0.111 to 0.211 %. The response time of control system shows that the depth is stabilized in the allowable range at the first time step. Depth variation graph shows appropriate response of control system to flow variations. Performance indicators and depth variations shows appropriate functioning of the control system. Relying on the results of this study, application of this control system in irrigation canal which provide higher flexibility and direct participation of water users in management of water delivery could be suggested.

1- Assistant Professor, Tarbiat Modarres University, Tehran, Iran. Po.Box: monem_mj@modares.ac.ir
Tel: 44196523-5, Fax: 44196524.
2- M.Sc. Student Tarbiat Modarres University, Tehran, Iran.

Keywords: Irrigation canals, Automatic control, Management of water delivery, P+PR, Downstream control.

INTRODUCTION

Most of Irrigation systems due to poor management are performing below expectation. Poor management in irrigation networks results to inadequate and unjust water delivery which contributes to unsatisfaction of water users. Management of water delivery and corresponding control systems has a great impact on performance of irrigation networks. Considering limited water resources and necessity of optimal con consumption of water, requires participatory management and increasing the level of contribution of water users in water delivery. In order to reach to this goal it is necessary to increase the level of flexibility of water delivery which in turn leads to low water losses and higher productivity at farm level. Higher flexibility requires implementation of advanced automatic control system such as regular and specific downstream control systems. Automatic downstream control systems provide opportunity for water users to participate in management of water delivery directly and receive the required amount of water at proper time. P+PR control system is one of control systems applied in irrigation canal to provide higher flexibility.

In this research the Global performance of P+PR[1] control system which provide direct farmers participation in management of water delivery is evaluated.

INTRODUCING P+PR CONTROL SYSTEM

Several control systems with different characteristics are developed for irrigation canals. P+PR control system which can be use in both upstream and down stream control system is introduced by USBR[2]. In this control system the gate adjustment is calculated using a proportional and integral relation and is applied by an electromotor installed on the gate. It is possible to use four different filters such as depth dead band, gate adjustment tolerance, electromotor speed, and hydraulic filter. Depth dead band is a depth tolerance around target depth. If water depth remains in this range no action will be done. Gate adjustment tolerance is minimum limit of gate adjustment. If the calculated gate adjustment is less than this limit no action will be done. Electromotor speed filter controls the speed of gate adjustment to be less than allowable range. Hydraulic filter diminishes gate adjustment due to minor depth variations. Hydraulic filter is calculated using equation 1 and 2.

$$Y_{fn} = \frac{C_{sf}(Y_{wn} + Y_{wp}) + Y_{fp}(1 - C_{sf})}{1 + C_{sf}} \tag{1}$$

$$C_{sf} = \frac{\Delta t}{2T_f} \tag{2}$$

1- Proportional Plus Reset

2- United States Bureau of Reclamation

Where y_f is filtered depth, y_w and y_t are observed and target depth respectively, C_{sf} is simulated filters constant, Δt time step, and T_f is time filter constant. The combined actions of all the filters lead to stable operation of gate.

In P+PR control system the controlled out put which is gate adjustment is calculated using equations 3, 4 and 5.

(3) $$\Delta G_p = K_p.(Y_{fn} - Y_t)$$

(4) $$\Delta G_i = K_i \int_0^k \left[(Y_t - Y_{fn}) \pm 0.5.Z_{db} \right] dt$$

(5) $$\Delta G_T = \Delta G_p + \Delta G_i$$

Where: K_p and k_i are proportional and integral coefficient respectively. ΔG_T, ΔG_i, ΔG_p are proportional, integral and total gate adjustment respectively, Z_{db} is allowable dead band and n and p subscripts refer to present and past computational time steps.

In automatic operation the downstream depth is observed by sensor. The observed depth is filtered by equation 1. The filtered depth is compared with target depth and proportional gate adjustment is calculated by equation 3. The filtered depth is compared with dead band, if it is out of dead band the integral gate adjustment is calculated by equation 4. In equation 4 the plus sign for 0.5 Z_{db} is for the time when filtered depth is above dead band and minus is for the time when filtered depth is be below dead band. Finally the total gate adjustment is calculated by equation 5. The total gate adjustment is compared to gate filter, if it is less than that the gate adjustment is set to zero. Considering total gate adjustment the required gate speed in operational time step is calculated and compared to motor speed. If calculated speed is greater than allowable speed, the gate adjustment is set to the multiple of allowable motor speed and operational time step.

INTRODUCING THE ICSS[1] MODEL

ICSS hydrodynamic model is developed by Manz to simulate hydraulic, hydrology, and operation of irrigation conveyance system (Monem, 1990). The model is able to simulate one dimensional, gradually varied steady and unsteady flow under different operational conditions and control structures in canal with any cross sections. In ICSS model, hydraulic structures are considered as a boundary condition. For performing the hydraulic simulation the relations of boundary conditions are computed in four step such as computation of steady flow (BC[2]#D), operation (BC#C), unsteady flow computation (BC#A), and updating the parameters of boundary condition (BC#B).

1- Irrigation Conveyance System Simulation
2- Boundary Condition

MATHEMATICAL MODEL OF P+PR CONTROL SYSTEM

This control system is developed for controlling a rectangular flat slide gate as a boundary condition no.12 (BC12) and combined with ICSS model by Massah (Massah, 1380). Here short introduction of four step of this model is presented.

STEADY FLOW SIMULATION

Steady flow computation is started from the most downstream structure with a specific discharge which is determined in input data file. At P+PR boundary condition considering the specified discharge and hydraulic equation of flat sliding gate, the initial gate opening is calculated.

SIMULATION OF OPERATION

In flat sliding gate manual and automatic operation is considered which could be specified in input data file. In automatic operation the options of upstream control or downstream control is provided. The switches of four filters explained earlier could be set to on or off. In automatic operation the subprogram type c (BC12C) is called in each time step and gate opening is calculated using equations 1 to 5.

UNSTEADY FLOW SIMULATION

In order to compute unsteady flow the continuity equation for upstream boundary condition (G_o) and momentum equation for downstream boundary condition (F_N) and their partial derivations with respect to depth and velocity are required. The automatic flat slide gate With P+PR downstream control system works under submerged condition and G_o and F_N equations are derived as equation 6 and 7.

(6) $$G_0 \ : \ A_1.V_1 - A_N.V_N \ = \ 0$$

(7) $$F_N \ : \ A_1.V_1 - C_d.b.GO \ .\sqrt{2g(Y_N - Y_1)} \ = \ 0$$

In which, A is flow cross sectional area, V is flow velocity, C_d is flat slide gate discharge coefficient, b is gate width, GO is gate opening, y is flow depth, the subscript 1 and N refer to first node of downstream reach and last node of upstream reaches respectively. In unsteady flow computation at each time step the A subprogram is called, the equation 6 and 7 and their partial derivations with respect to depth and velocity are calculated and unsteady flow equations for whole canal reaches are solved for one time step. After calculating depth and velocity at all nodes along the canal, the B subprogram is called and flow depth and discharge are updated in boundary condition matrices.

CONTROL SYSTEM PERFORMANCE INDICATORS

For performance evaluation of P+PR control system, 3 indicators introduced by ASCE[1] (Clemens et al., 1998) and Monem (Monem et al., 1382) are used. The indicators are as follows:

Maximum absolute error (MAE). This indicator shows the maximum deviation between observed and target depth during operational period and is calculated by equation 8.

$$MAE = \frac{\max\left| y_t - y_{target} \right|}{y_{target}} \quad (8)$$

In which: Y_t is observed depth at time t and Y_{target} is target depth.

Integral of absolute magnitude of error (IAE). This indicator shows the average deviation between observed and target depth during the operational period and is calculated by equation 9.

$$IAE = \frac{\frac{\Delta t}{T} \sum_{t=0}^{T} \left| y_t - y_{target} \right|}{y_{target}} \quad (9)$$

In which: Δt is computational time step, T is operational period, and other terms are defined earlier.

System response time (SRT). System Response time is a time duration from when the observed depth is getting out of allowable range until when it get back and stabilized in the allowable range. The allowable rang is a tolerance around target depth as a percentage of target depth ((1±0.5% X) $\times Y_{target}$) value of X is determind by user (Monem et al., 1382). The smaller SRT shows the faster system response.

ASCE CANAL NO.2 AND OPERATIONAL SCENARIO

Different control Algorithms are tested and evaluated in different canals with different specifications. Canals specifications have a significant impact on performance of control algorithms. Therefore performance evaluation, comparison, and judgment of proposed control algorithms under this situation is not an easy job. To overcome these short comings ASCE working group has suggested two standard canals for testing new control algorithms (Clemmens et al, 1998). In this research ASCE canal no.2 is selected to test and evaluate the performance of P+PR downstream control system for participation of water user in water delivery management in irrigation canals. In this study the numerical coefficient of P+PR control system are also calibrated. The canal has a trapezoidal cross section with 1.5H: 1V side slope, and manning roughness coefficient of 0.02. Canal specifications are given in table 1.

1- American Society Civil Engineers

Table1. Specifications of ASCE standard canal no. 2

Reach	Length (m)	Upstream Elva. (m)	Downstream Elva. (m)	Bed slop	Bed width	Upstream Structure	Downstream Structures
1	7000	400.0	399.3	0.0001	7	Reservoir	1- turnout 1 2 – slide gate 1
2	3000	399.1	398.8	0.0001	7	Slide gate 1	1- turnout 2 2 – slide gate 2
3	3000	398.6	398.3	0.0001	7	Slide gate 2	1- turnout 3 2 – slide gate 3
4	4000	398.1	397.5	0.0001	7	Slide gate 3	1- turnout 4 2 – slide gate 4
5	4000	397.5	397.1	0.0001	7	Slide gate 4	1- turnout 5 2 – slide gate 5
6	3000	396.9	396.6	0.0001	7	Slide gate 5	1- turnout 6 2 – slide gate 6
7	2000	396.4	396.2	0.0001	7	Slide gate 6	1- turnout 7 2 – slide gate 7
8	2000	396.0	395.8	0.0001	7	Slide gate 7	1- turnout 8 2 – slide gate 8

In mathematical model all physical and hydraulic specifications of the canal and boundary conditions are defined in form of input data file for ICSS model. The flat slide gate between canal reaches is equipped with P+PR automatic downstream control system. At the canal inlet, a reservoir with automatic outlet is considered to satisfy the downstream requirements automatically. At the end of canal a stop log weir with fix height is considered. The numerical coefficients of the control system are calibrated under wide rang of discharge variation. In order to evaluate the performance of the developed P+PR control system for participatory management and operational scenario with large flow diversion from canal is simulated. In this operational scenario simulatenious and large flow diversion by water user at turnout no 1, 2, 3, 4 and 6 is taken into account. The response of control system and mutual impacts of check structures are studied and performance of control system is evaluated. For this study the dead band and gate tolerance are taken as 1 and 3 millimeters respectively. Target depth for check structures no. 1, 2 and 3 are 2, 1.9 and 1.8 meter respectively and for check structures no. 4, 5 and 6 are 1.7 meter. For this study the steady flow of 3 CMS and simultaneous flow diversion of 0.3 CMS by all turnouts is considered as initial condition for the first 12 hours. Total operational duration is taken as 36 hours. During this time the flow diversion of turnout no. 1, 2, 3, 4 and 6 have been increased and decrease by about 200% in two steps. Table 2 shows turnout flow diversion variations during operational period.

Table 2. Flow variation turn out no. 1, 2, 3, 4 and 6

Time (hour)	0-12	12-18	18-24	24-30	30-36
Discharge (CMS)	0.300	0.900	1.500	0.900	0.300

RESULTS AND DISCUSSIONS

For performance evaluation of P+PR control system for participatory management the explained operational scenario is simulated in ASCE standard canal no.2 and performance indicators are calculated for check structures which are give in table 3. Depth, discharge, and gate opening variations downstream of all check structures are depicted in figure 1 to 6.

The performance indicators given in table 3 shows that the maximum amounts of MAE and IAE for check structures are 0.211 and 0.014% respectively.

Table3. Performance indicators for P+PR control system

Check no.	**MAE (%)**	**IAE (%)**	**SRT (1%)**	**Maximum deviation of depth from target level (cm)**	**Average deviation of depth from target level (cm)**
1	0.200	0.010	0.000	0.400	0.019
2	0.211	0.014	0.000	0.400	0.026
3	0.111	0.007	0.000	0.200	0.012
4	0.118	0.003	0.000	0.200	0.006
5	0.177	0.004	0.000	0.300	0.007
6	0.119	0.001	0.000	0.200	0.002

The maximum depth deviation from target depth downstream of check structures is about 0.4 cm and the maximum average of depth deviation during delivery period is 0.026 cm. The value of SRT within %1 range for all check structures is zero. This states that depth was within the allowable range during delivery period. Considering practical accuracy required in irrigation networks for control structures the value of the indicators is completely acceptable.

Comparing the performance of check structures show that the value of indicators for mid-canal structures are in the same range, how ever for the upstream structures the indicators have higher values. This result shows that mid-canal structures have performed better than upstream structures. This result might be due to accumulative impact of diversion variations from downstream moving toward upstream. Since the control system is P+PR downstream control, moving toward upstream the amount of discharge delivery variation is accumulated. At the canal upstream the discharge variation is higher than in mid–canal which results to higher depth variation for upstream structures compared to mid-canal structures during operational period.

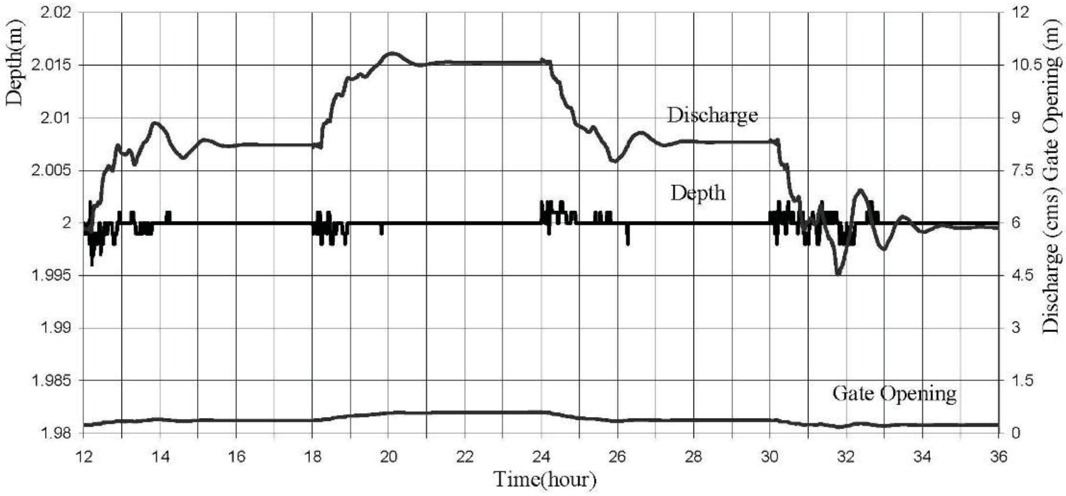


Figure 1. Depth and discharge variation downstream of check no. 1 and its gate opening

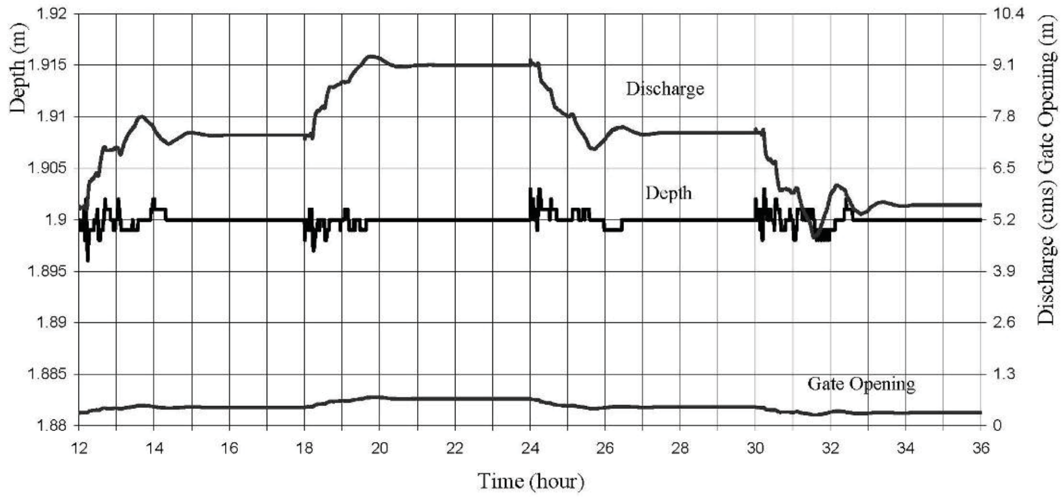


Figure 2. Depth and discharge variation downstream of check no. 2 and its gate opening

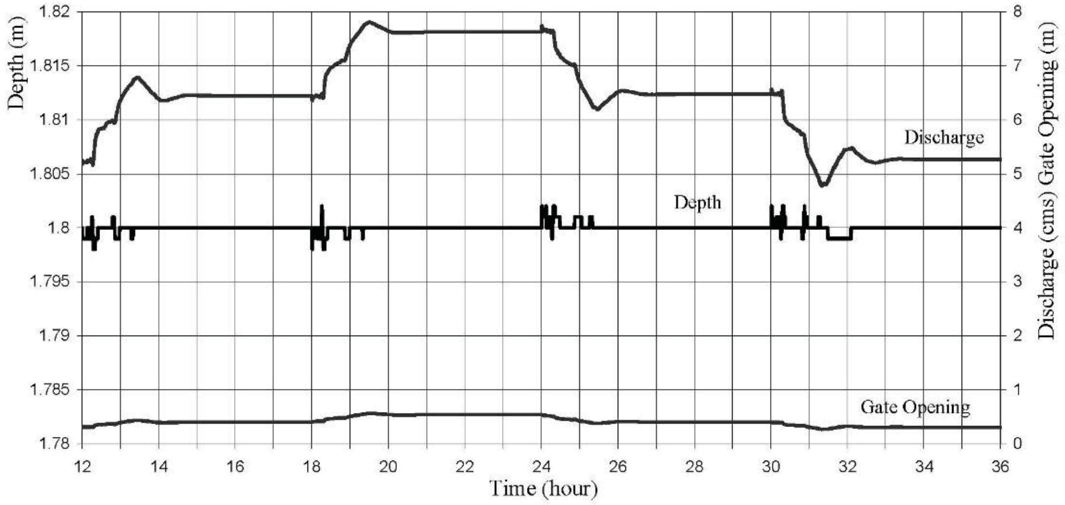


Figure 3. Depth and discharge variation downstream of check no. 3 and its gate opening

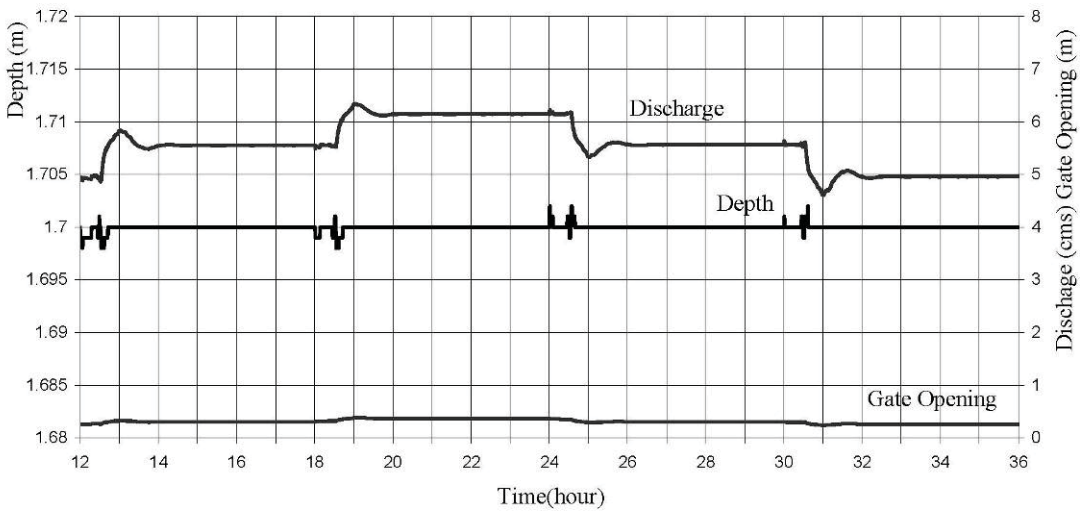


Figure 4. Depth and discharge variation downstream of check no. 4 and its gate opening

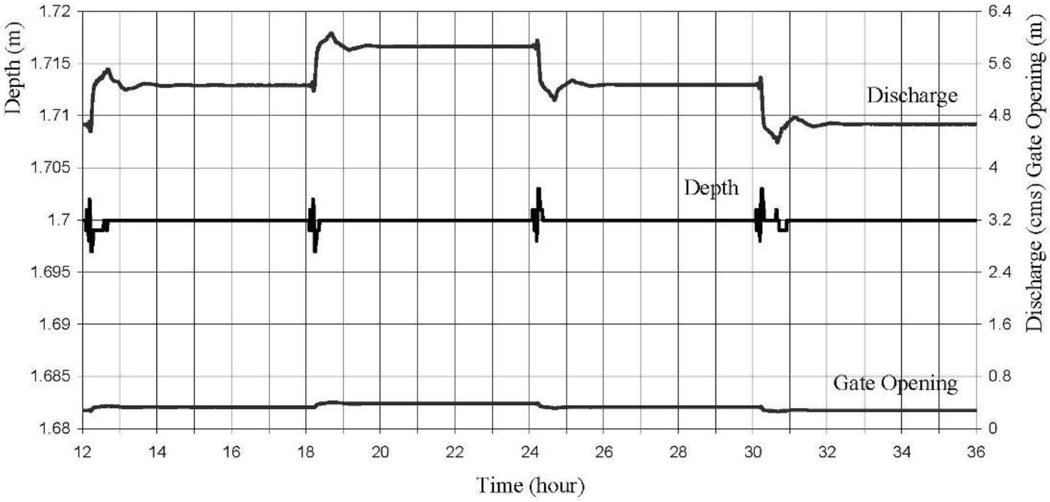


Figure 5. Depth and discharge variation downstream of check no. 5 and its gate opening

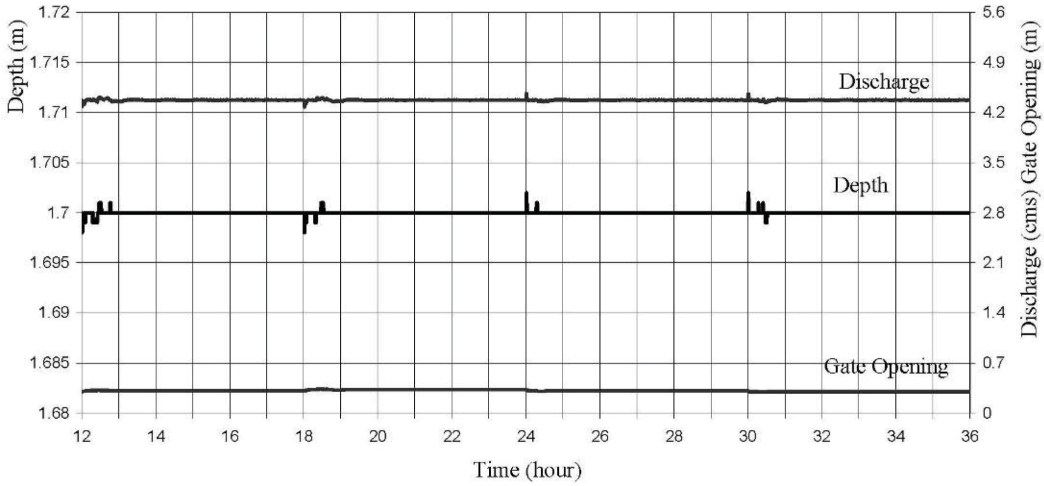


Figure 6. Depth and discharge variation downstream of check no. 6 and its gate opening

Figures of depth variation downstream of structures show that for each structure after controlling the initial variations due to diversion change, the depth is maintained at target depth and is stabilized in short time.

As a conclusion it could be states that the performance of developed P+PR automatic downstream control system for simultaneous and significant diversion variations of outlets is quite suitable and it could be used for direct participation of water users in management of water delivery.

REFRENCES

1. Clemmens, A. J., Kacerek, T. F., Grawitz, B., and Schuurmans, W. 1998. Test case for canal control algorithms. Journal of irrigation and drainage engineering. ASCE, 124:23-30
2. Massah, A., 1380. Development of mathematical Model of AMIL, AVIS, and P+PR control systems in irrigation Canals. A thesis submitted for the degree of Master of Science in Irrigation Structure. Faculty of agriculture, Trabiat Modares University (In Persian).
3. Monem, M. J., 1375. Introducing simulation model of irrigation networks and their performance optimization. 8th seminar of Iranian national committee of irrigation and drainage (In Persian).
4. Monem, M. J., Massah, A., 1382. Development of mathematical Model of AMIL hydraulic structure. 4th iran hydraulic conference, SHIRAZ (In Persian).

THE ANALYSIS AND EVALUATION OF THE PUBLIC'S INTERACTION IN THE SUFICHAY NETWORK

Farnaz Joulazadeh, Nafise Paknia, Zahra Pouryaghoub[1]

ABSTRACT

According to the experienced cases in the past, the experience of the locals' participation in using water resources like the other forms of public interactions are influenced by modern management trends in a way that the concept of resource management and the relevant actions are changed for the most part. Although the establishment of up – to – date forms of management appears unavoidable because of the growing population and industrialization of the cities and urgent need for water energy, and also changing the public form of management into the governmental form is viable and the financial support by the governments plays a great role in the completion of this kind of projects, the absence of the public in these projects can be a remarkable weak point.

When establishing new irrigation and drainage networks, which is one of the effective ways in water resource development, we can benefit the participation of the public in scheduling, construction, completion and maintaining the projects, and of course the participation of the public in completion and maintenance is more tangible and therefore we got the idea to start our Water - Supplying Cooperative Companies (WSCCs).

The WSCCs is clear picture of the public's participation in economical and social affairs management and accordingly the members who benefit the water resource projects have had a close interaction with the authorities based on the framework of the WSCCs and therefore the effective life of the projects has been increased and a better use of water, soil resources and investment offerings has been achievable and as a result, the project of the Sufichay WSCCs in the East Azerbaijan can considered as a successful model of this kind, but of course, like any other project, it has its own possible weaknesses which we are going to analyze in the following article:

Key word: public's interaction, Water - Supplying Cooperative Companies, evaluation

1- MSc. Students of urmia university
Email: farjulazadeh@yahoo.com Fax: 03352573497

INTRODUCTION

Over the past one hundred years, villagers in the East Azerbaijan Province have employed various methods including: making infiltration tunnel, digging wells, making diversion weirs (which initiates side – flowing streams) across rivers, conducting water to reservoirs for long – term storage. To manage water - supply affairs based on seasonal changes, monitoring taking turns in water resource using and distributing water resource shares among individuals, villagers invented some methods and formed special groups.

After the advent of technology and industries in villages and development in communication facilities between cities and villages, traditional regulations began to suffer. In response to villagers' new requirements, WSCC were established in villages which were totally or partially located in each dam's downstream to supply water for agricultural uses.

Around 76 WSCCs were established in the East Azerbaijan Province by financing 50,000,000,000 Rials (about 5,600,000 $) from 1992 to 1998.The first WSCC was started in Maragheh district (1992 – 1994) and later there was the second one in Bonab district (1994 – 1996).

GEOGRAPHICAL LOCATION OF THE SUFICHAY NETWORK:

The Sufichay Network is located in the southeast of the Urumia Lake. It is a 120 kms drive from Tabriz City to this area in the southwest direction. The area neighbors with the southern sides of the Sahand Mountains in the north, with the western sides the Sahand Mountains and the Mardogh Valley in the east, with the sides of the Gharah Gheshlagh Mountains in the south and with the southeastern coastal salt marshes of the Urumia Lake in the south.

THE LANDS COVERED BY THE NETWORK:

The lands covered by the Sufichay irrigation and drainage n network are mainly divided and nominated as the following:

District one (the lands around Maragheh City): this area is composed of the gardens and farms just above the Maragheh Diversion weir and also those around Maragheh City extending for approximately 2500 hectares.

District Two (The right - hand bank): This area is composed of the farming lands and gardens of The Maragheh – Bonab Plain and those around the Sufichay River and is irrigated by the canal initiated from the Maragheh Diversion weir located in the right – hand bank of the river.

District Three (the left – hand bank): This area also extends as a wide plain in the left – hand bank of the Sufichay River. The water needed is supplied by Maragheh and Khanghah Diversion weirs. Whenever there is more rainfall, the extra water from the Maragheh Divrsion weir is directed to the Khanghah Diversion weir for more irrigation purposes.

District Four (Bonab): this area is composed of the gardens and farms of the villages under the Sufichay River and the Bonab Plain and also some parts of the gardens and farmlands of the villages Zavaregh and Chelghaie.

Note: Since the WSCCs of district one are not included in this statistics project, the related information is not available in this article.

THE RESEARCH METHOD

In this research for statistically evaluation of the WSCCs we benefited from measurement method. It is apparent that for estimating the research variables we employed two different types of questionnaires (one for the WSCCs and one for the managers) and possible variables include: the weak points and the problems relating to the activities carried on by the WSCCs which cosist of from irrigation problems, improvement in water use, collecting water charges, volunteering quality of the members and so on.

THE OUTCOME OF THE EVALUATION

A: An evaluation of the general features of the WSCCs:

- The number of the members: the studied WSCCs can be divided into three categories.
  1. The WSCCs with 32 to 100 members (7 cases)
  2. The WSCCs with 110 to 182 members (5 cases)
  3. and the WSCCs with230 to 575 members (5 cases).
- The average age of the members: the minimum and maximum age of the members the the mentioned WSCCs is respectively 20 and 95 years old. The members of the WSCC in the group 3 are the oldest of all groups.
- Literacy rate: more than 60 % of participants are literate. The literacy average of the members of the district 4 is the highest of all districts.
- The managers' occupation: the majority of the WSCC managers (a total of 10 people) are farmers.
- The extension of under farming lands of each member: the most extension of the cultivated lands belongs to the members of the district 2 (4.3 hectares) and the least extension goes to the district 4 members (1.2 hectares).
- The extension of under farming lands of each WSCC: the most extension of under farming lands belongs to the Big Russet in the district 2 (1774 hectares) and the least extension goes to the Ghal'eh Khaleseh WSCC in the district 2 (72 hectares).
- Earning statistics: the most income is for the WSCCs in the district 3 and the least amount is for the district 4. The last but not the least, even in the district 3 only 5.25 percent of the members approved a large increase in their income.

B: An evaluation of general issues of the WSCCs:

These issues have been evaluated in two categories. Firstly internal problems which relate to the system and performance of the WSCCs and secondly the external problems which do not initiate from the performance of the system but is imposed by different external factors.

1. THE INTERNAL ISSUES:

- Holding general meetings: the highest percentage of sessions is for the district 2 WSCCs (8.77 percent) and the lowest is for the district 3 WSCCs (3.33 percent).
- Attending the general meetings: 50% of the members of the most of the WSCCs approved that they didn't attend the meetings.
- Paying membership fees: for the most part the members of the WSCCs of the network (80 percent) paid the fees.
- Holding elections for management committee in peace and freely: in the most of the districts the elections for the management committee have been held in peace and freely and of course in the district 4 we have the highest approval.
- Possible disputes among the members: our findings show that there have been just a few disputes among the members and the district 4 has had the least number.
- Possible disputes between the members and the managers: in this part we can also see the least number disputes and the district 2 has had the least number.
- Possible disputes among the WSCCs: this kind of disputes are also very rare to happen and the highest number is for the district 4 because 3.33 percent of the managers have reported that there have been some WSCCs that have not cooperated with the other WSCCs because of their own benefits.
- The references for settling the disputes among the WSCCs and their success in doing that: the findings show that the members have referred to the Water Affairs Offices of Bonab and Maragheh cities, the management committees and the managers, the Taavon offices and the judicial centers respectively to settle their disagreements.
- The percentage of approval and fee – paying to the managers: most of the members in the three districts approved paying fees to the managers and even have emphasized that they will approve this idea if it is posed in the annual general meeting.

2. THE EXTERNAL ISSUES:

A: The common issues of all of the districts:

The common issues can be categorized as the following:

- The members do not perform the obligations they agreed on in the contracts.
- Water supply is not safe and dependable.

- Water shares are not distributed equally.
- There are a few number of expert supervisors for the network.
- The members have to pay water share charges even if there are some natural disasters or pests or there is no crop to be harvested.
- There is no schedule for maintaining the equipment and tools.

B: The common issues of each district:

These problems include:

- The water flow gates are not shut adequately.
- The mangers make no request from the judicial officials to ban the illegal use of water resources.

A SET OF USEFUL MANUALS

In order to improve the network of the WSCCs, we offered the following suggestion in three categories:

A: The short – term manuals:

1. Creating a steady formula for water share charges.
2. Scheduling a dependable repairing and maintaining method for measurement tools and devices and providing up - to - date information for the members all the time.
3. The Water Affairs offices of Maragheh and Bonab should coordinate with the WSCCs of the region when attracting new members.
4. The view points of the general managers should be considered of much value when signing new contracts.
5. The water share tariff be delivered on time.
6. The canals should be cleaned and maintained regularly.
7. The network should benefit a judicial expert to defend the rights of their society.

B: The average – term manuals:

1. Scheduling for distributing water shares equally, sufficiently and on time.
2. A supervision and evaluation unit should be established.
3. The WSCCs should be supported to found an office of affairs.
4. Performing cleaning and maintaining operations at the beginning of every farming season can have many benefits such as: cooperation among the members, creating a working relationship between the WSCCs and the water Organization of the region, reporting the changes and improvements and so on.

5. Identifying the model WSCCs and introducing them in public and offering rewards to the members and managers.

C: The long – term manuals:

1. Encouraging the different units of the Water Organization to accelerate the performance of affairs and duties relating to irrigation and drainage networks which are going to be used for the first time.
2. Having periodical visits to the networks of other regions to learn more about the weak points and the strong points of the Sufichay Network and teaching the managers how to measure the imported water to update their input and regarding the role of education in the development of the WSCCs.
3. Making a bed for active participation of the members in cooperation affairs.
4. Making an effort to vitalize the necessity of following cropping pattern and water supply needs and appropriate use of synthetic fertilizers and ... .

REFERENCES

1. Tamanna, S. 2003. The analysis of the public's interaction in the Sufichay network and the evaluation of these interaction situation. Research report of ministry of East Azarbaijan regional watercorp
2. Taghavi, N. 2001. The analysis of the public's interaction in solution villages irrigation issues. Research project of East Azarbaijan cooperation.

FARMERS NETWORK FOR WATER SECTOR REFORMS IN SOUTH INDIA

R. Doraiswamy[1]

ABSTRACT

This paper deals with practical experiences of one of the fundamentals of PIM i.e. Farmers Network for Water Sector Reforms (FNWSR) in South India undertaken by JalaSpandana. The basis to FNWSR is that the farmers are generally excluded from the process of policy formulation, and are mainly conceived as implementers of policies designed by others. It is posited that an explicitly multi-stakeholder policy process and balanced representation of the different interest groups in that, including farmers, will enhance the quality, acceptability and pace of water sector reform. In order to strengthen PIM through making PIM a farmers' baby, FNWSR was initiated in Karnataka and later extended to States like Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry, which have adopted PIM policy. The main objective of FNWSR is to facilitate farmers – the major stakeholders in irrigation to participate effectively in the political process of policy formulation and implementation. INPIM supported JalaSpandana to carry out FNWSR in 2004 and 2005. The results in terms of regular interaction with the concerned Ministry and Bureaucracy, pressure group to lobby for PIM, motivate fellow farmers to function efficiently at various levels of WUAs, etc seem alarming. In Andhra Pradesh, FNWSR succeeded in building pressure on the government and ensuring the continuity of WUAs. In Karnataka, the members of FNWSR succeeded in effective formation and functioning of project level WUAs institutions in four major irrigation projects. Similarly, in Tamil Nadu and Pondicherry, FNWSR have made significant impact on the structure and functions of WUAs and PIM.

1- Mr. R. Doraiswamy is working as water resource specialist at JalaSpandana – South India Farmers Organisation for Water Management, Bangalore, India. JalaSpandana is a non-governmental organisation formed by the representatives of water users associations in South India. It has head office at Bangalore and State offices in Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry. Contact: doraiswamyr@vsnl.net, doraiswamyr@rediffmail.com, www.jalaspandana.org, Phone: 91-80-22286161, 09448268401, Address: 72, 7th Cross, Chikkathayappa Street, Vasanthnagar, Bangalore 560052, India, www.jalaspandana.org.

1. INTRODUCTION

In South India, states like Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry have adopted Participatory Irrigation Management (PIM) either through passing an exclusive Act or enacting its existing Irrigation Act that emphasizes on PIM (Doraiswamy, 2003). The PIM policy formulation and implementation has been the business of the government agency in a top down approach. The government agency enjoy the discretionary powers in implementation of the PIM programme, which often lead to down play essential elements required for the success of the PIM. Farmers who occupy the central position in the Participatory Irrigation Management were not given prime importance in policy formulation and implementation. Moreover, mere enactment of policies that emphasizes on WUAs in itself is not sufficient to make PIM success, what matters significant is the successful implementation and periodic review of the policy.

Participatory Irrigation Management viewed from the larger context of decentralisation policies of the government suffers more from lack of political will to empower end users. The regular interventions of the governments as per the wishes of the political parties hampers the progress of PIM programme. In South India, the field experiences clearly shows that the interest shown to WUAs vary from Minister to Minister (who occupies water resources portfolio in the government) and from the government to government. This approach generates the gap between the government and users and to a large extent push farmers in to passive receiving end. As the success of PIM lies in equal and successful participation of all the stakeholders working in water sector, it is imperative that PIM becomes majority concern. In the process of PIM policy formulation and implementation, farmers need to take lead role and treat PIM as their baby and not some thing given from outside. Thus, Farmers Network for Water Sector Reforms (FNWSR) was conceived to facilitate PIM programme in South India.

In this paper, we discuss the emergence and success of farmers network and way forward in the context of PIM in South India, especially in states like Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry in South India. The first and second section deals with area profile, description of farmers network, need in general and in specific context of PIM policy. The third section illustrates how the FNWSR was carried out in South India emphasizing on the support received from International Network for Participatory Irrigation Management (INPIM). Fourth section deals with achievements, lessons and future perspective of applicability.

1.1. AREA PROFILE

Andhra Pradesh is geographically the fourth largest State in India (67.8 million acres) and the fifth largest, in terms of population. The population of Andhra Pradesh was about 75.7 million in 2001 with a population density of 272 inhabitants per square kilometer (Government of Andhra Pradesh, 2004). The rainfall in the state varies from 568 mm to 1159 mm. Agriculture in Andhra Pradesh is largely dependent on rainfall: more than 50 per cent of the cultivated area is rainfed. It is estimated that only 42 per cent of the gross sown area of nearly 11.36 million acres receives irrigation water at present. The state produced Vision 2020 document emphasizing on holistic approach towards water resources development (Naidu, 2000).

Karnataka is the eighth largest State in the country and is located in the Deccan plateau. The geographical area of Karnataka is 1,90,498 sq.km accounting for 5.81% of the total area of the Country. Up-to the end of March 2000 a total irrigation potential of 36,22,921 ha. (Including ground water is created). The annual normal rainfall is 1138 mm received over 55 rainy days. It varies from as low as 569 mm in the east to as high as 4029 mm in the west. About 2/3rd of the geographical area of the State receives less than 750 mm of rainfall (Government of Karnataka, 1995, 2002).

Tamil Nadu and Pondicherry is geographically eleventh largest State in India (130 lakh hectares) and has 7 per cent population of the country. The net area sown in Tamil Nadu is about 60 lakh hectares (ha) of which about 30 lakh hectares or 50 per cent get irrigation facilities from sources like canals (9.50 lakh ha), Tanks (9.00 lakh ha) and Wells, Tube wells (11.50 lakh ha).

The total area of Pondicherry is 293 Sq kms with a population of 6,08,338 according to 1991 census. In 2000, the net area cultivated is 24,402 ha, gross area cultivated is 42,398 ha and net irrigated area is 21,628 ha and gross irrigated area is 33,643 ha. There are 84 tanks systems distributed in Pondicherry and Karaikal regions of which 54 are tank systems and 25 are non tank systems. There are over 8000 tube wells, which irrigates the net area of about 15000 ha.

2. FNWSR DESCRIPTION

2.1. WHAT IS FARMERS NETWORK

Farmers Network is the powerful way of bringing farmers from different parts of the political boundaries and various levels of water bodies on to one common platform. This common platform enable farmers to play constructive role in the politics of water especially in the process of policy formulation and implementation. In other words, Farmers network is basically to gain access to water policy details, power politics, new technology and information relevant to water sector reforms. In this paper, farmers network refer to farmers using the water in the command area in various sizes of water bodies like major, medium and minor irrigation projects. This farmers network could not be called as Network of Water Users Associations as WUAs were not established in all irrigation projects in these States, either due to lack of policy or the delay in the process of policy implementation. Thus, the project FNWSR is conceived as a means to generate political vibration in the Participatory Irrigation Management domain. FNWSR is established at various levels of water bodies especially at irrigation project level, sub basin and basin level (JalaSpandana 2004, 2005).

2.2. WHY FARMERS NETWORK IN PIM

Although, there are several benefits accrued out of farmers network, in this section we focus on farmers network in the context of PIM. The development and management of irrigation sector in India, especially in South India is highly centralised by the Government agency. Participatory Irrigation Management or Irrigation Management Transfer calls for devolution of power, which gives rise to interest conflicting among various stake holders. As a result, section of the people particularly elected representatives and officers of Irrigation Department enjoying authority over irrigation system find all means and ways to evade power transfer to WUAs (Hooja 2006). The history of decentralisation in India including the local government like Panchayat Raj Institutions (PRI) clearly shows that the already well established group like Member of Legislative Assembly (MLA) and Member of Parliament (MP) are not happy in loosing power over their constituencies especially on water, which is one of the powerful natural resources (Baumann, 1999).

Farmers are usually on the receiving end and are highly unorganized. To self initiate and volunteer to form themselves into network becomes rather difficult task as the farming conditions in South India is more on a subsistence level, the farm size varies from 1 hectare to 15 hectares per farmer. They lack common platform to negotiate and contest for rights, responsibilities and powers from their counterpart like Irrigation Department and other elected representatives. Farmers network enable to provide necessary and appropriate recommendations to the Government, which otherwise may not be captured in true and original sense (Alders et. al, 1993).

In South India, there are hardly any NGOs directly working with WUAs in major and medium irrigation systems. The normal practice adopted by irrigation department in eliciting information from the water users associations is to pool few WUA representatives in workshop organised at State level. This approach still becomes the task of irrigation department and never turns out to be farmers task on a regular continuous basis. It becomes imperative to establish farmers network to make PIM a majority farmers concern on a permanent basis (Aw and Diemer 2005).

Farming community in South India, is again not to be viewed as homogenous group. The farming community is divided in to several groups based on caste, class, region, location of the irrigation project in a river basin, etc,. In most of the villages in South India, the village hegemony is based on elite characteristics, which could be social, economic and political in nature. The past experiences have shown that small group of people in the WUAs control the entire functioning of WUAs, which is against the principles of PIM, thus hampering the success of PIM. It is pre requisite for the success of PIM to bring farmers on one common platform cutting across these boundaries.

FNWSR reduces the damage caused due to varied perceptions and interpretations made by different stakeholder groups on Participatory Irrigation Management. In South India, during the initial periods Participatory Irrigation Management and Irrigation Management Transfer was interpreted by section of the people as transfer of burden from Government to farmers. In addition, PIM was interpreted as an attempt made by the Department to divide farming community and further create conflict among water users. Moreover, the tendency among farmers in South India is that they believe and come to common understanding when fellow farmers speak positively. This is the better approach in sharing scarce resources and resolving water conflicts (Doraiswamy 2004). The field experience shows that farmer to farmer technology transfer is more efficient than any other agency attempting to convince farmers on several positive aspects of PIM. In other words, knowledge sharing between and among farmers from different irrigation projects help boost the success of the PIM programme.

The recent trend in water allocation and demand shows that there is increasing demand from various sectors like drinking, industries, environment, tourism, etc. It is imperative to farmers to safeguard the interest of farming community which is dependent on Agriculture to the extent of 65 to 70 per cent in India.

Farmers network plays constructive role in modernisation programme carried our in canal irrigation projects. Most of the modernisation programme in canal system focus on physical works with emphasis on technical aspects of irrigation. The social component especially involvement of water users is not given prime importance despite of WUAs existence in the project area.

3. CONTEXT OF PIM

3.1. PIM IN ANDHRA PRADESH

In order to improve irrigation performance, the Government of Andhra Pradesh took a progressive and innovative step to empower the farmers to manage and operate the irrigation resources through formation of Water Users Associations in the year 1997. An exclusive Act called Andhra Pradesh Farmers Managed Irrigation Act of 1997 was enacted, which provides the legal support for the functioning of these WUAs. At National and International Level, this is a major reform effort and is the first large scale exercise at delegation of water management powers to water users (Mollinga et al 2004). The objectives of this reforms are carrying O & M of the irrigation system and increase in agriculture production. The Act emphasized on formation of water users organisation at three level namely Water User Associations (WUAs), Distributary Committee (DC) and Project Committee (PC) for major irrigation projects, two tier structure (WUA/PC) for medium irrigation projects and single tier structure (WUA) for minor irrigation.

During 1997, the elections were held democratically and 10,292 WUAs with 46,755 TCs members and 172 DCs formed in the State. Each WUA consisted of 4-10 TC members and there was direct elections to both TC members and President. Initially, the tenure of WUA was for five years. Andhra Pradesh Economic Reconstructing Project (APERP) is taken up to the tune of 962.26 crores, which has Water Users Associations support component. These organisations have taken up O & M and Minimum Rehabilitation works.

The APFMIS Act 1997 was further amended by the Congress Government. Some of these amendments are co-opting the members of other elected bodies like PRI and MLAs and MPs in to WUAs. One of the positive aspect of these amendments is to make WUAs as permanent bodies with every two years one third of the Territorial Constituency (TC) member of WUA go out on rotation system and fresh elections conducted only in that TC area.

It is reported that there are several benefits accrued after the formation of farmers WUAs, some of them are bridging the gap ayacut of 10.07 lakh acres[1], no water problem or tension in tail end of the command area, farmers got 5-10 bags extra paddy, no crop submersion – flood waters quickly drained, the works were executed with speed and quality and there were no excess in estimated rates.

The water charges were increased more than three folds i.e. from Rs. 60 per acre (paddy crop) to Rs. 200 per acre. In order to carry out the O&M by WUAs, provision was made in the Act to re-plough the water charges collected in the WUA area on the basis of proportion.

1- As reported by I & CAD, GOAP

Table 1. Project/District wise WUAs in Irrigation Projects in Andhra Pradesh

<table>
<tr><th rowspan="3">Name of the District</th><th colspan="5">No of WUAs</th></tr>
<tr><th colspan="2">Major</th><th>Medium</th><th>Minor</th><th>Total</th></tr>
<tr><th>Total WUAs</th><th>Project Wise WUAs</th><th></th><th></th><th></th></tr>
<tr><td>Adilabad</td><td>33</td><td>SRSP-8
Kadam -25</td><td>38</td><td>260</td><td>331</td></tr>
<tr><td>Ananthapur</td><td>48</td><td>TBP HLC -48</td><td>22</td><td>305</td><td>375</td></tr>
<tr><td>Chittoor</td><td>0</td><td></td><td>12</td><td>580</td><td>592</td></tr>
<tr><td>Cuddapah</td><td>78</td><td>TBP HLC- 46
KC Canal</td><td>16</td><td>217</td><td>311</td></tr>
<tr><td>East Godavari</td><td>208</td><td>Thandava Project-12
Godavari Delta System -145
Yelluru Irrigation System-25
Chagalanadu LIS-26</td><td>17</td><td>211</td><td>436</td></tr>
<tr><td>Guntur</td><td>398</td><td>Nagarjuna Sagar Right Canal-255
Krishna Delta System-143</td><td>0</td><td>64</td><td>462</td></tr>
<tr><td>Karim Nagar</td><td>163</td><td>SRSP-163</td><td>18</td><td>495</td><td>676</td></tr>
<tr><td>Khammam</td><td>79</td><td>Nagarjuna Sagar Left Canal-79</td><td>38</td><td>381</td><td>498</td></tr>
<tr><td>Krishna</td><td>307</td><td>Nagarjuna Sagar Left Canal-100
Krishna Delta System-207</td><td>12</td><td>270</td><td>589</td></tr>
<tr><td>Kurnool</td><td>118</td><td>TBP HLC-6
TBPLLC-57
KC Canal-55</td><td>12</td><td>159</td><td>289</td></tr>
<tr><td>Mahabubnagar</td><td>39</td><td>RDS-34
PJP-5</td><td>5</td><td>520</td><td>564</td></tr>
<tr><td>Medak</td><td>0</td><td></td><td>14</td><td>550</td><td>564</td></tr>
<tr><td>Nalgonda</td><td>116</td><td>Nagarjuna Sagar Left Canal-86
Musi Project-30</td><td>9</td><td>596</td><td>721</td></tr>
<tr><td>Nellore</td><td>92</td><td>Pennar Delta System -68
Somasilla Project-24</td><td>43</td><td>630</td><td>765</td></tr>
<tr><td>Nizambad</td><td>85</td><td>SRSP-8
NizamSagar-77</td><td>16</td><td>279</td><td>380</td></tr>
<tr><td>Prakasam</td><td>165</td><td>Krishna Delta System-17
Nagarjuna Sagar Right Canal-148</td><td>24</td><td>300</td><td>489</td></tr>
<tr><td>RangaReddy</td><td>0</td><td></td><td>5</td><td>184</td><td>189</td></tr>
<tr><td>Srikakulam</td><td>100</td><td>Vamsadara Project-54
Narayanapuram Anicut System25
Nagavali System -21</td><td>6</td><td>416</td><td>522</td></tr>
<tr><td>Visakhapatnam</td><td>16</td><td>Thandava Project-16</td><td>18</td><td>331</td><td>365</td></tr>
<tr><td>Vizianagaram</td><td>4</td><td>Nagavali System-4</td><td>49</td><td>444</td><td>497</td></tr>
<tr><td>Warangal</td><td>85</td><td>SRSP-85</td><td>23</td><td>658</td><td>7566</td></tr>
<tr><td>West Godavari</td><td>149</td><td>Krishna Delta System-16
Nagarjuna Sagar Left Canal-2
Godavari Delta System-131</td><td>13</td><td>226</td><td>388</td></tr>
<tr><td>Total</td><td>2283</td><td></td><td>410</td><td>8076</td><td>10769</td></tr>
</table>

Table 2. Project / District wise Distributary Committee in Andhra Pradesh

S.No	Name of the Project	Name of the District	No of D.Cs
1	**2**	**3**	**4**
1	Vamsadhara Project	1. Srikakulam	8
2	Nagavali	1. Srikakulam 2. Vizianagarma	4 1
		Subtotal	**5**
3	Narayanapuram	1. Srikakulam	5
4.	Tandava Reservoir	1. Visakappattinam 2. East Godavari	3 2
		Sub Total	**5**
5.	Godavari Delta System	1. East Godavari 2.West Godavari	25 20
		Sub Total	**45**
6	Yeleru Project	1. East Godavari	5
7	NSRC	1. Guntur 2. Prakasam	30 18
		Sub Total	**48**
8	NSLC	1. Nalgonda 2. Khammam 3. Krishana 4. West Godavari	10 9 13 -
		Sub Total	**32**
9	Krishana Delta System	1. Krishna 2. Guntur 3. Prakasam 4. West Godavari	29 20 2 3
		Sub Total	**54**
10	Pennar Delta System	1. Nellore	6
11	Somasila Project	1.Nellore	5
12	K.C.Canal	1. Kurnool 2. Cuddapah	8 6
		Sub Total	**14**
13	TBP HLC	1. Ananthapur 2. Cuddapah 3. Kurnool	5 6 1
		Sub Total	**12**
14	TBPLLC	1. Kurnool	10
15	RDS	1. Mahabubnagar	6
16	Nizamsagar	1. Nizamabad	10
17	Kadam Project	1. Adilabad	5
18	SRSP	1. Karimnagar 2. Warangal 3. Adilabad 4. Nizamabad	21 9 1 -
		Sub Total	**31**
19	Musi Project	1. Nalgonda	6
		Grand Total	**312**

3.2. PIM IN KARNATAKA

In order to make the best utilization of available water, the State in June 2000 amended its Irrigation Act of 1965. The amendments emphasise irrigation management turnover from the irrigation Department to Water Users Cooperative Society (WUCs) at primary, distributary, project and State level. At present there are about 3000 WUCs registered under the Cooperative Act in the State and making progress in forming project level federations in major irrigation systems (Doraiswamy, 2001, 2005).

The WUCs are empowered to decide on the cropping pattern, fix and collect water charges based on the volumetric supply and conflict resolution. Further, WUCs are entrusted the task of carrying out Maintenance work and Water Management through formal Memorandum of Understanding (MOU) between Irrigation Department and WUCs. In addition, the WUCs were given other rural development works like laying roads to farm lands called as Our road our farms *'Namma Holla Namma Rasthe'*. WUCs are also encouraged to take up other income generating activities like fertilizers and pesticides dealings, and other agriculture inputs. At present, there are four project level water users institutions in major irrigation systems namely Malaprabha and Ghataprabha Irrigation systems in Krishna Basin in North Karnataka and Harangi and Kabini Irrigation Project in Cauvery Basin in South Karnataka.

Table 3. CADA Wuse WUAs Progress in Karnataka as of 31-05-2006 Area: in Ha

Sl. No	Name of the CADA	Area Irrigated	Target (No. of WUCs)	Achievement as of 31-05-2006					
				Registration		MOU		Handing Over	
				No. of WUCs	Corresponding area	No. of WUCs	Corresponding area	No. of WUCs	Corresponding area
1	Tungabhadra Project	363000	835	418	238000	147	96500	147	96500
2	Malaprabha & Ghataprabha	344739	600	552	274700	457	229858	228	229858
3	Cauvery Basin Project	416768	599	549	228795	228	120539	228	119083
4	Upper Krishna Project	259834	530	468	229438	362	177471	229438	362
5	Bhadra Reservoir Project	118737	298	290	115784	105	42545	115784	105
6	Irrigation Project Zone	36402	79	59	26143	22	8365	26143	22
	Total	**1539480**	**2941**	**2336**	**1112860**	**1321**	**675278**	**1321**	**673822**

3.3. PIM IN TAMIL NADU AND PONDICHERRY

Tamil Nadu initiated the formation of WUAs in 1980s. Further, in 1994-95 Agriculture Engineering Department undertook formation of WUAs under World Bank assistance more seriously by providing financial assistance. Later, in the year 2000, the Government of Tamil Nadu enacted New Act called Tamil Nadu Farmers Management Irrigation System (TNFMIS) Act on the same lines as that of Andhra Pradesh. According to TNFMIA Act WUAs will be formed at three levels of the irrigation system namely primary, distributary level and project level.

Table 4. District wise details of Elections to WUAs under WRCP in Tamil Nadu

S.No	Name of the District	District wise details of coverage of Elections			
		Total No of WUAs	Total No of Villages	Total No of TCs	Total Command
I.	**Chennai region**				(ha)
1.	Kanchipuram	276	306	1218	47905
2.	Tiruvallur	21	39	102	4248
3.	Vellore	229	391	1022	33472
4.	Dharmapuri	47	159	256	15791
5.	Tiruvannamalai	154	387	734	30753
6.	Villupuram	80	233	381	22461
7.	Cuddalore	78	313	430	25094
	Sub Total	**885**	**1828**	**4143**	**179724**
II.	**Madurai region**				
8.	Pudukkottai	1	1	4	84
9.	Dindigul	17	34	81	4637
10.	Madurai	56	433	337	72563
11.	Theni	32	65	176	11824
12.	Virudhunagar	9	35	53	7197
13.	Ramanathapuram	69	218	369	21577
14.	Sivagangai	82	246	402	34034
15.	Thuthukudi	66	152	317	16401
16.	Tirunelveli	162	536	793	65685
17.	Kanyakumari	46	158	285	25955
	Sub Total	**540**	**1878**	**2817**	**259957**
III.	**Pollachi region**				
18.	Erode	49	135	288	49993
19.	Coimbatore	101	507	603	119887
	Sub Total	**150**	**642**	**891**	**169880**
	Grand Total	**1575**	**4348**	**7851**	**609561**

T.C: Territorial constituencies.

The government of Pondicherry is carrying out community based tank rehabilitation programme under the financial assistance of European commission. The NGOs are engaged extensively to build the capacity of tank users. However, there is no State policy that emphasizes on PIM and empowerment of tank users associations.

4. IMPLEMENTATION OF PIM IN SOUTH INDIA

4.1. ANDHRA PRADESH

Andhra Pradesh, one of the States in India to enact an exclusive Act called Andhra Pradesh Farmers Managed Irrigation Systems Act of 1997 did not establish Project Committees although envisaged in the Act. It confined formation of WUAs to primary and distributary level of irrigation projects. As a result water users participation at main system management and its linkages with primary level WUAs, which is a prerequisite for system performance and water use efficiency did not materialize. The main system management and the decision making authority rest with the project engineers and district officers.

The procedures to conduct elections to WUAs is centralised, the decision to hold elections and its operational logistics was in the discretion of the State Government. One of the major draw back of such procedures on PIM is the break in the continuity of WUAs. After the WUAs completion of the first tenure, the State Government did not conduct elections even to primary and distributary level WUAs across the State and the management was taken over by Irrigation Department from WUAs. As a result, there was a gap in the continuity of WUAs.

The revenue collection in irrigation projects constitute central position on the sustainability of WUAs. In AP, irrigation is provided by Irrigation Department and revenue collection is carried out by Revenue Department. As a result of multiple department involvement, the collection rate was below 50 per cent. The sharing of data regarding the extent of water tax collection by revenue department is not appreciable. Further, the apportionment of water tax to WUAs, DCs and PCs are not regularly carried out by revenue department. Thus, WUAs are deprived of their due share of revenue generated out of water tax and reduces interest in the functioning of WUAs. As a result, the maintenance of irrigation system is directly affected (Vaidyanathan 1999).

4.2. KARNATAKA

In Karnataka, the registration of WUAs is carried out under State Cooperative Societies Act with the fixed range of command area for each WUAs. This policy applied to major, medium and minor irrigation projects. The model adopted in Karnataka was similar to Maharashtra model of cooperatives[1]. This created serious problems in minor irrigation sector in pooling up more than 10 to 15 tank spread in the radius of 10 Kms to form one society. Initially, in major irrigation projects, the momentum of forming water users associations did not gear up due to cooperative principles.

1- Maharashtra adopted major reforms in water sector in 2005. It moved away from cooperative model to ensure total participation of the water users.

The formation of WUAs federation at project level requires high degree support from department officials. As the WUAs in Karnataka are registered under Cooperatives Act, the representatives of WUAs had to shuttle between the two departments. In addition, the absence of model bylaws caused immense delay in the process of formation of project level users institutions.

Although, PIM policy applies to all irrigation projects in the State, some of the officials of the irrigation department were not prepared to adhere to the policy contents. The representatives had to struggle obtaining the information on the implementation of the policy in some irrigation projects to convince the officers in their project. One such example is the water tax collection by the WUAs, representatives of federations had to show to their officers the singed MOU obtained from other irrigation projects.

The volumetric supply of water management in Karnataka over looks the issue of quota fixation and entitlements. Memorandum of Understanding signed between Irrigation Department and WUA with regard to water management is one sided. As the quota and entitlement is not clearly defined, the breach of MOU do not give any hold on the part of WUAs to make irrigation department accountable. The quota and entitlement is the pre requisite to achieve equity particularly in irrigation projects that has large tail end deprivation (Doraiswamy and Mollinga P, 2002).

As per the policy, the operation and maintenance of the canal network lies with the Irrigation Department. In order to ensure quality and quantity work, WUAs insist that it should be the responsibility of WUAs.

4.3. TAMIL NADU AND PONDICHERRY

In Tamil Nadu, PIM was not implemented with true spirit as envisaged in the PIM policy. The formation of WUAs confined to primary level despite of the policy mentioning about distributary and project level committees. Further, the formation of WUAs under the World Bank supported project called Water Resources Consolidation Project (WRCP) was extended to only those irrigation project that was covered under it. The formation of WUAs as per TNFMIS Act was not taken up in Cauvery River Basin, one of the major river basins in Tamil Nadu. In rest of the irrigation projects, the WUAs formed under Command Area Development (CAD) Programme continued. Thus remain the difference in the structure of WUAs formed under CAD programme and WRCP. The operation and maintenance work of the canal system is carried out by government department with little transparency in the process of tendering the works to contractors.

The TNFMIS Act was made uniform to all categories of irrigation projects. This created problem both in terms of structure and functions of users participation in tank system. Tank system is usually treated as social institution that belongs to village. The new policy tried to segment tank users associations on the basis of the fixed range of area to form the tank users associations. As a result in some cases tank users associations belonging to particular tank was divided and in most cases it became collection of several tanks that went against the traditional principles of tank management locally called as *kudimaramath*.

Although, farmers participation in tank restoration programme is well appreciated in Pondicherry, the State Water Policy is yet to be shaped. FNWSR generated good amount of awareness among the farmers. The State is yet to detail PIM policy, for which the farmers are rising their voice.

5. INPIM SUPPORT TO FNWSR

JalaSpandana developed concept note to facilitate "Farmers Network for Water Sector Reform in South India" based on the very positive experience with farmers network approach, gained particularly in Karnataka through Pragathi a Farmers NGO. Upscaling and strengthening of farmers networks on water issues is felt necessary to increase the momentum of water sector reform. The concept note was further developed and transformed into project proposal with the support of Dr. Peter P Mollinga, Senior Research Fellow, ZEF, Bonn, Germany and Mr. J. Raymond Peter, the then Executive Director, INPIM, Washington D.C. JalaSpandana was fortunate enough to get the financial and other support from INPIM through South Asian Consortium for Interdisciplinary Water Resources Studies (SaciWATERs) Hyderabad. The project was successfully implemented in Andhra Pradesh, Karnataka, Tamil Nadu and Pondicherry.

5.1. OBJECTIVES OF FNWSR

General objectives

- Contribute to a participatory water resource planning process by establishing Farmers Organization that can actively engage in discussion and decision-making on water resource policy formulation and implementation at different levels.
- Integrated Water Resource Management on social equality and equity through Farmers Organisation.
- Overall development of water resource sector and reduce burden on the State exchequer.

Specific objectives

- Establish and Strengthen a Farmers Organization in four States exclusively to work on water sector.
- Capacity building of office bearers and farmers in this Farmers Organisation
- Design and implement strategies and activities for effective water management.
- Preparation of Water Policy by Farmer's Organisation

5.2. MAIN ACTIVITIES

Networking farmers

Establishing communication structure

Undertake capacity building

Define and undertake water sector reform initiatives and strategies

5.3. FNWSR DESIGN

The FNWSR was designed in such a way that the water users network could be established at various levels of irrigation system. In major and medium irrigation system depending on the size of the command area and the length of the canal, farmers workshop were organised to suit the convenience of the farmers. In tank systems, the workshops primarily focussed at district level. As most of the irrigation projects with in the sub basin and basin level are getting into conflict due to the centralised decision making regarding which project should go for irrigation during the season. Farmers network at sub basin was felt essential to address issues between the irrigation projects with in sub basin and basin. JalaSpandana organised series of state level workshops that facilitated farmers to directly interact and place their resolutions to the Ministers, bureaucracy and policy makers.

The workshops adopted methodology that facilitated farmers to review National and State Water policy, Participatory Irrigation Management policy and its implementation bottlenecks, roles and responsibilities of the farmers in making PIM successful programme and sustainable interaction with system managers. The workshop played constructive role in bringing farmers from tanks, irrigation projects and officers on a common platform to find ways and means to carry PIM forward in these States. In the process, Non Governmental Organisations were roped in to make PIM majority concern (Rooy 2001).

5.4. FNWSR INTERACTION WITH STATE OFFICERS

FNWSR maintained good relation with concerned stakeholders, especially department officials were carried out in all the three States. The officers like Secretaries of Irrigation, Officials of Water and Land and Management and Training and Research Institute (WALAMTARI), Hyderabad, Irrigation Management Training Institute (IMTI) Trichy and Water and Land Management Institute (WALMI), Dharwad, Engineer in Chief for WRO, Chief Engineers, Superintendent Engineers, Executive Engineers and Assistant Executive Engineers and other officers of Irrigation/Water Resources Organisation (PWD) and CADA were constantly interacted on issues pertaining to PIM.

5.5. PIM TOUR (YATRA)

JalaSpandana after visiting most of the districts in the respective states and building rapport with department officials and other professionals assessed the need for state level workshops of farmers on PIM. The field visits also showed the need to have a dialogue with the authorities involved in PIM programme in the States. The tour programme was organised with coordination and cooperation of regional organisations shown below in the tour plan. Mr. J. Raymond Peter, ED, INPIM participated in one such PIM Yatra undertaken in Andhra Pradesh, Karnataka and Tamil Nadu.

5.6. INFORMAL PROJECT LEVEL COMMITTEES

JalaSpandana facilitated farmers network to evolve into district/project level informal committees in irrigation projects. Farmers participation in main system management is felt essential. Although, the PIM policies in Andhra Pradesh, Karnataka and Tamil Nadu have envisaged project level committees, only Karnataka is formally making progress in formation of project level committees. Thus, JalaSpandana facilitated formation of informal project level committees to set model and lobby for formation of project level committees in irrigation projects.

5.7. NATIONAL WATER POLICY

As the National Water Policy is published in English and many farmers in the States, particularly in South India are unable to read and digest the same. Thus, JalaSpandana translated the National Water Policy in Kannada, Tamil and Telugu and circulated free of cost to farmers.

5.8. STATE ORGANISATIONS

One of the significant development under FNWSR is the emergence of Farmers Organisation to work exclusively on water related issues with special emphasis on PIM. These State organisations are registered under the State societies Act and have offices in respective States. Pragathi – Farmers Society for Rural Studies and Development, an NGO formed by the farmers/ representatives of water users/farmers already existed in Karnataka. Similar organisation in Andhra Pradesh and Tamil Nadu was successfully formed as follows.

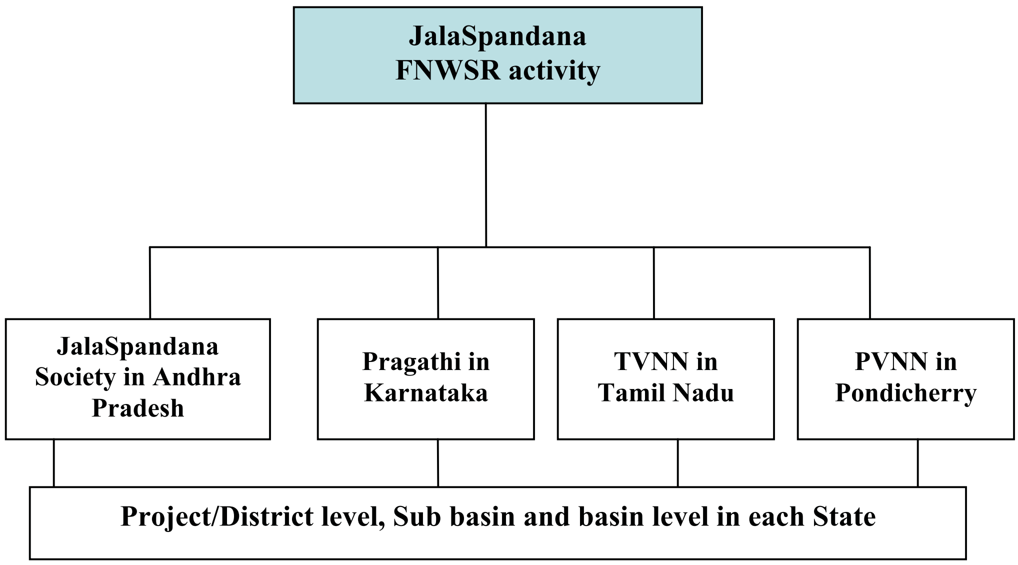


Diagram 1. State Organizations of Farmers Network

5.9. SOUTH INDIA FARMERS' WORKSHOPS

Under FNWSR three workshops were organised at South India Level were organised in January 2004 at Indian Social Institute, Bangalore, December 23rd 2004 at United Theological College campus, Bangalore and 25th May 2005 at BMP, Urban Health

Centre, Bangalore. Dr. Peter Mollinga, participated in first two workshops and Mr Raymond Peter participated in third workshop. The agenda of the workshop were to share the project experiences, best practices, intervention methodology, success of PIM and lessons learnt from each of these State and strategies for future action.

5.10. PUBLICATION

JalaSpandana has purchased the domain www.jalaspandana.org and the site is a multilingual website that caters to farmers and other stakeholders with the information on the water sector reforms including capacity building and other on farm activities. JalaSpandana is publishing quarterly newsletter in English and regional languages like Kannada, Tamil and Telugu. In Andhra Pradesh, the title of the newsletter is JALAVANI, in Karnataka it is called RAITHA PRAGATHI and in Tamil Nadu it is called NEERVALAM

6. OUTPUTS

6.1. ANDHRA PRADESH

In Andhra Pradesh, as mentioned earlier that the government was not keen on continuing WUAs after the completion of first term either through holding fresh elections or continuing the existing body. In 2003, farmers network took initiative and met the then Chief Minister of Andhra Pradesh, Mr. N. Chandra Babu Naidu and demanded to continue WUAs in Andhra Pradesh. There was a direct interaction between the farmers (former representatives of WUAs) and Chief Minister of the State. Further, the farmers network developed itself into pressure groups and continuously build pressure on the government through interacting with bureaucracy and other Ministers. The Chief Minister of Andhra Pradesh took a decision to conduct elections to WUAs in thirteen districts that had water in the reservoir during the year. The elections to remaining nine districts was not conducted.

The district/project level workshops organised by FNWSR facilitated formation of district level and project level informal committee of WUAs. This committees interacted among WUAs and with department officials to boost the success of PIM. Ground level lobbying for the elections for WUAs in remaining nine districts in Andhra Pradesh.

In 2005, state level workshop was organised in which the Minister for Major and Medium Irrigation participated. Farmers presented the policy recommendations and demanded Minster to conduct elections in remaining nine districts. The resolution copy of the workshop was prepared and circulated to Minister for Major and Medium Irrigation, Minor Irrigation, Lift Irrigation, Revenue and Finance Departments. The Government of Andhra Pradesh took a decision just in three days after submission of resolution copy of the workshop to conduct elections in nine districts.

The **capacity building** in irrigation projects was the most neglected part in the irrigation development. Farmers network further conceptualised Participatory Training Programme (PTP) to build capacity of WUAs and farmers on various facet of water management. The concept PTP was shared with Irrigation and CAD, Government of

Andhra Pradesh, which was further developed by the participation of officers. Mr. S.P. Tucker, Principal Secretary, I&CAD conducted several rounds of workshops to develop the concept PTP and identify NGOs to carry out capacity building in irrigation projects. An attempt is also made to revitalize Water and Land Management and Training and Research Institute (WALAMTARI).

The **operation and maintenance** is yet another issue that needed attention for the successful functioning of WUAs. As per the PIM policy, revenue department is to make apportionment to WUAs, DC and PC out of the water tax amount collected from the water users. This apportionment was not happening for past few years and WUAs were unable to carry out operation and maintenance of canal system and also to function as WUAs. Farmers network had regular meetings with department officials and demanded for apportionment to carry out regularly.

Farmers network pursued the issue of water tax collection and apportionment. To a large extent representatives of WUAs were divided over the issue of WUAs taking over the responsibility of water tax collection. Farmers network highlighted the positive elements of WUAs taking over water tax collection responsibility. As a result, many WUAs express willingness to collect water tax collection. The department is considering to hand over water tax collection on pilot basis in irrigation projects where WUAs are expressing interest.

6.2. KARNATAKA

In Karnataka, farmers network made significant landmark in the field of PIM. Operation and maintenance work by the WUAs, appropriate representation of WUAs in Apex body, Cooperative Act versus Societies registration Act were some of the issues raised by farmers network.

Informal project level WUAs federation established by FNWSR speed up the process of formation of WUAs, increase membership and project level federation. The members of FNWSR was instrumental in forming federations in Ghataprabha irrigation project and Harangi Irrigation Project. The secretary of JalaSpandana who was spear heading FNWSR became the president of project WUAs federation in Harangi irrigation project in Cauvery Basin. She is the first woman to become the president in a federation that has 86 WUAs with the command area of 54591 hectares. This is an historical achievement in Gender and PIM.

Karnataka adopted volumetric supply of water distribution. WUAs and Irrigation Department enter into Memorandum of Understanding to carry out the water management. The MOU with present model is one sided and do not give any leverage for the WUAs to make claims due to breach of contract by the government. One of the significant pre requisite for volumetric supply is fixing the quota and entitlements. This element is overlooked by the department. Thus, volumetric supply is not being carried out in true spirit. FNWSR is working out mechanism with the government to move towards actual volumetric supply. In addition, the issue of water rights and entitlements is also being taken up by FNWSR.

FNWSR is helping department officials in implementation of PIM policy. The process adopted elsewhere in forming WUAs, federations, MOU, operation and Maintenance, etc. are documented and circulated to officers in other parts of the State. In other words, FNWSR produce documentary evidence to show the progress of PIM in different irrigation projects in the State, this is one of the strategies for speedy implementation of PIM. This approach is very helpful in irrigation projects that has some resistance from the department officials to empower WUAs.

6.3. TAMIL NADU AND PONDICHERRY

Similarly, in Tamil Nadu FNWSR empowered farmers with the contents of State water policy and PIM programme in the State and elsewhere in the country. The networks developed at district/project level started interacting with the irrigation and CAD officials constructively and started demanding the implementation of project level committees.

The PIM programme with the fixed area for WUA ran into serious problems in tank systems. FNWSR identified these problems encountered during the elections in terms of the Structure, functions and other logistics and brought to the notice of PIM experts and policy makers. This was realized by the policy makers and considered for changing the area of each WUA under tank systems.

At present FNWSR is constructively involved in the policy discussions on PIM in Tamil Nadu. It intends to make PIM one of the major component in the forth coming project taken up by Tamil Nadu under the financial loan from World Bank to the tune of Rs. 3050 crores to take up the project titled Irrigated Agriculture Management of Water Resources Management.

The members of FNWSR both in Tamil Nadu and Pondicherry became pro active in terms of operation and maintenance of water bodies. WUAs demanded the details of the works tendered to carry out in the area of WUAs and regularly monitored the works. FNWSR also promoted establishment of offices for WUAs and records maintenance.

6.4. Women in Networks

A special focus was laid on promoting women in networks, which is found essential to develop awareness among fellow women and build pressure on the government to promote women's role in WUAs through the necessary amendments to PIM policy in the State. The intensified meetings promoting women participation in WUAs resulted very positively in Harangi Irrigation Project, one of the major irrigation project in Cauvery Basin in which the General Secretary of JalaSpandana (member of farmers network) became president of project level WUCs federation.

Trainings were provided to members of farmers network on leadership qualities and motivating the elected representatives. One of the main issues is to avoid confrontation with the other elected representatives in the constituency by way of interacting with them and briefing the activities undertaken by WUAs and achievements like water use efficiency, water tax collection, quality and quantity of work, sense of ownership over canal system by water users and reduction in burden on the State exchequer.

7. FUTURE APPLICABILITY

The FNWSR has immense scope in promoting PIM in South India. It is quite evident from the field experience that the success of PIM lies with intensive struggle between the water users, bureaucracy and elected representatives of other bodies. There is consistent resistance from most of the department officials to empower WUAs. On the other hand, the culture of change in the government or Minister also creates gap in the frequency level of interest extended towards PIM. Most of the state governments express large part of interest in construction of projects and less importance to software component of irrigation projects like empowerment of WUAs.

In all these states, the implementation of PIM even to the extent envisaged in the state policy is lagging behind. Under such circumstances, further amendments or modifications in existing policies become mirage when left to the bureaucracy to carry PIM forward. There is need for constant pressure or the lobbying group to ensure successful implementation of PIM and further changes in PIM policy.

8. CONCLUSION

Farmers network is the pre requisite for the success of participatory irrigation management that warrants devolution of power from department to water users. FNWSR not only enables negotiate and contest with the government agency but also facilitate building consensus and cooperation from fellow farmers. The implementation process becomes smoother through FNWSR. It is evident from the above text that the FNWSR has created considerable impact on PIM through creating awareness among farmers, direct interaction with the policy makers, facilitating implementation process, etc, with limited financial resources. PIM in these states are majority concern, particularly farmers.

REFERENCE

1. Alders Carine, Haverkort Bertus and Veldhuizen Van Lawrens, (1993): Linking with Farmers Networking for Low External Input and Sustainable Agriculture, Intermediate Technology Publishers, U.K.

2. Aw Djibril and Diemer Geert (2005): Making a Large Irrigation Scheme Work, A case study from Mali, The World Bank, Washington D.C.

3. Bauman Parri (1999): Democratizing Development? *Panchayat Raj Institutions in Water Shed Development in India* in Participatory Watershed Development – Challenges for twenty-first century, Oxford University Press.

4. Doraiswamy R and Bhavanishankar B.S (2001): Irrigation Policy Reforms – *Peoples perceptions on the amendment bill to irrigation act of 1965 of Karnataka*, Sahayoga, Bangalore

5. Doraiswamy R, et. al, (2003): Farmers Organisation and Water Policy in South India, edited by Doraiswamy R, Mollinga P and Rajagopal A, published by Wageningen University, The Netherlands and National Institute of Rural Development, Hyderabad, India,

6. Doraiswamy R and Mollinga P, (2002): Tailenders and other deprived in irrigation in India: Tamil Nadu, Karnataka and Maharashtra by A. Rajagopal, R. Doraiswamy, Peter P Mollinga, K.J. Joy and Suhas Paranjape, Irrigation and Water Engineering, Wageningen University, The Netherlands.

7. Doraiswamy R and Gujja B, (2004): Understanding Water Conflicts - *Case Studies from South India,* Pragathi – Farmers Society for Rural Studies and Development, Bangalore.

8. Doraiswamy R, (2005), Irrigation Policy Reforms in Karnataka, in book Karnataka Economy: *Issues and Concerns,* edited by Vishwanatha and Jayasheela, published by Academic Publishers, Bangalore.

9. Government of Andhra Pradesh (2004): Annual Report of Irrigation and Command Area Development, Unpublished Report, Hyderabad, India.

10. Government of Karnataka (1995): Brochure on Irrigation Statistics in Karnataka 1993-94, Directorate of Economics and Statistics, Bangalore.

11. Government of Karnataka (2002): Karnataka at a glance 2000-2001, Directorate of Economics and Statistics, Bangalore.

12. JalaSpandana, (2004, 2005): Farmers Network for Water Sector Reforms in South India, Unpublished Report, JalaSpandana, Bangalore.

13. Hooja Rakesh, (2006): Management of Water for Agriculture – *Irrigation, Watersheds and Drainage,* Rawat Publications, India.

14. Mollinga P, Doraiswamy R and Engbersen K (2004): Capture and Transformation: *Participatory Irrigation Management in Andhra Pradesh, India* in The Politics of Irrigation Reform, edited by Peter P Mollinga and Alex Bolding, Ashgate Publishers, London.

15. Naidu Chandra Babu, 2000: Plain Speaking, Viking – Penguin Books India.

16. Vaidyanathan A, (1999): Water Resources Management, *Institutions and Irrigation Development in India,* Oxford University Press.

PARTICIPATORY IRRIGATION MANAGEMENT (PIM) IN MAHARASHTRA STATE, INDIA – A CASE STUDY

Dr. Sanjay Belsare[1]

ABSTRACT

Maharashtra has long tradition of farmers' participation in irrigation management in the form of Phad systems and Malgujari tanks. In the nineties, the first Co-operative Water Users Association (WUA) was established in the Mula Irrigation Project. With its success, Government of Maharashtra (GoM) has been promoting PIM in the State.

WUA are responsible for the operation, maintenance and management of the area and receives the prescribed water quota in the form of bulk volumetric supply along with the freedom to grow crops of their choice. Over last 10-15 years, there was appreciable growth in WUAs. There are number of success stories, underlining the importance of WUAs. On the other hand, there are also some instances of no appreciable improvement in performance of irrigation projects with WUAs.

To evaluate the actual performance of WUAs a study was conducted, which covers WUAs from various parts of the State. The paper discusses the outcome of this study, reasons for good or poor performance, difficulties in functioning, area which needs attention, challenges in up-scaling etc and steps taken by GOM to solve the difficulties in progress of PIM. The paper also discusses future course of action to strengthen PIM initiatives in the State.

1. INTRODUCTION

Maharashtra State is situated in the southwest of India. It is the third largest State (30.8 Mha) with the second largest population (97 million) in the country. Agriculture has been the prominent occupation to provide food and fiber to the growing population of the State. The State economy is dependent upon agricultural production. Irrigation facility is regarded as the key element of irrigated agriculture. The modern agriculture and irrigation practices play a key role in alleviating rural poverty.

1- Dr. Sanjay Belsare - Executive Engineer , Palkhed Irrigation Division, Water Resources Department (WRD), Nashik-2 Fax No. 0253 – 2579904, Email: jaltirth@rediffmail.com

2. CLIMATE AND RAINFALL

The State has a tropical climate. The annual rainfall varies from 400 mm to 6000 mm. The average rainfall of the State is around 1300 mm of which 88% falls during June to September and remaining between October to December. It has therefore a greater impact on State's water resources planning.

3. SURFACE WATER RESOURCES

The geographical area of the State is divided into basins of Krishna, Godavari, Tapi, Narmada and narrow basins of west flowing rivers of Konkan. The average annual availability in above basins is anticipated as 163.82 BCM, out of which permissible use as per interstate tribunal award is 125.94 BCM.

3.1 IRRIGATION POTENTIAL CREATED

Irrigation potential of hardly 0.274 Mha was created in the State during pre-plan period i.e. prior to 1950. As agriculture is the prominent occupation, the State has concentrated upon construction of irrigation projects. There was manifold increase in irrigation potential creation. By 2005, the State has created 4.0Mha irrigation potential using surface water resources. The State has constructed almost 2700 major, medium and minor irrigation projects, which is around one half of the country's total population of dams. The ultimate irrigation potential, through both surface water and ground water resources, has been estimated as 12.6 Mha.

4. HISTORICAL DEVELOPMENT OF PIM

Maharashtra has a long tradition of participatory irrigation management. Phad systems in Northern Maharashtra and Ex-Malgujari tanks in Eastern Vidarbha are living examples of it.

4.1 PHAD SYSTEM

The Phad system on canals has been implemented since the medieval period on Panzara, Girna, Mosam & Burai Rivers, which flow through Nasik & Dhule districts. Water was diverted by constructing bandharas across these rivers. Several beneficiaries belong to a single Phad. A sole type of crop is used to be harvested in a Phad. They use to cultivate perennial crops in the first Phad, two seasonals in the second, seasonals in the third whereas a crop would be grown in the fourth in case water is available. The crops are rotated in different phads in a 4-year cycle.

4.2 MALGUJARI TANKS

The tenure of Gond kings saw the creation of series of tanks in Vidarbha. It is given to understand that nearly 10,000 tanks had been constructed nearly 300 to 350 years back in the districts of Chandrapur, Gadchiroli, Bhandara & Nagpur in Wainaganga Basin through the entirely private enterprise of the Kohali community i.e. by deploying their own money and efforts.

4.2.1 Development in post-independence period

To encourage participation in irrigation management by farmers, the then Bombay Province in 1947 had created canal advisory committee, block level water committee and corporate body of landowners.

In 1976, Maharashtra Irrigation Act-1976 has come into force. The chapter III, section 60, of the act provides for modalities in which water committees are proposed to be formed and to whom water is to be supplied on volumetric basis.

Considering National Water Policy-1987 and Maharashtra Irrigation Act-1976, the Government of Maharashtra initiated pilot project of establishing water users' associations. In 1989, on Mula project Shri. Datta Sahakari Pani Wapar Sanstha has been established in Nevasa Taluka of Ahmednagar Disrtict. The same year 3 WUAs were established in Waghad project of Nashik District.

5. STATUS OF PIM IN MAHARASHTRA

The State has broadly divided into six regions viz. Konkan, Western Maharashtra, North Maharashtra, Marathwada, Nagpur and Amravati. These regions have different geographical, social, agro-climatic scenario, which certainly has had an impact on PIM development in the State. The progress of development of WUAs in the State is given below.

Sr. No	**Region**	**Functioning**		**Agreement is over but yet to start functioning**		**Registered but yet to sign agreement**		**Proposed (Under various stages of formation)**		**Total**	
		No.	CCA (ha)	No.	CCA (ha)	No.	CCA (ha)	No.	CCA (ha)	No.	CCA (ha)
1	Konkan	8	958	5	604	18	2863	59	12829	90	17254
2	Nagpur	37	12955	112	48403	207	90014	549	275478	905	426850
3	Amravati	178	51361	86	26548	309	86914	589	251356	1162	416179
4	North Maharashtra	190	66492	142	41272	195	64086	73	21460	600	193310
5	Western Maharashtra	309	73027	30	3600	267	69372	1958	482599	2564	628598
6	Marathwada	138	63321	87	37965	272	135394	67	20851	564	257531
	Total	860	268114	462	158392	1268	448643	3295	1064573	5885	1939722

5.1 SUCCESS STORIES OF PIM

There are many success stories of PIM. Waghad Project, Nashik is a medium project having CCA 9642 ha. As stated earlier, PIM started with 3 WUAs in tail end, now WUAs are formed all over the command area. The WUAs have formed project level federation, which is successfully managing irrigation of the entire project. Similarly, Katepurna Project, (Akola), Manar Project, (Nanded), Kukadi Project, (Pune) and Choolband Project, (Gondia) have shown remarkable improvement in project performance with PIM. The Pimpalnare Project, (Nashik), Tekepar LIS, (Bhandara) and Bramhanwada Project, (Buldhana) are successful examples, exhibiting improvement in utilisation and diversification as a result of practicing PIM.

5.2 EVALUATION OF WORKING OF WUAS FUNCTIONING IN THE STATE

Directorate of Irrigation Research and Development (DIRD), Pune is established in 1969. It is a state-level organisation dealing with research in irrigation management and drainage works. DIRD has field offices throughout the State. This organisation is also entrusted with work of monitoring and evaluation of WUAs in the State.

In order to know the working of WUAs in the State, GoM has carried out evaluation of functioning WUAs in the State. Total 439 WUAs throughout the State have been taken up for the study. The regional breakup of these WUAs is as follows 8 from Konkan, 64 from Marathwada, 139 from Western Maharashtra, 150 from North Maharashtra, 8 from Nagpur, 70 from Amravati. For this purpose information was collected through specially designed questionnaires. The DIRD has compiled all the information and analysed it. The analysis came out with the following findings.

5.3 GENERAL FINDINGS

The general findings of the evaluation study are summerised below. Konkan region is coastal region having plentiful rainfall. However, it is backward in irrigation and PIM development is negligible. The Western Maharashtra's north part is drought prone and is irrigationally developed. It shows significant development in PIM. It is also worth to take note of Amravati region where PIM movement is gathering momentum in recent time due to appreciation of benefits of PIM, by the farmers.

There are WUAs having:

- CCA between 100 to 250 ha — 42 %
- Chairman aged above 40 years — 77 %
- Chairman working for more than 2 years — 79 %
- Irrigation throughout the stretch of the canal — 69 %
- Users numbering between 100 to 200 — 51 %

Evaluation of WUAs brought to the fore following facts:-

- After transfer of management to WUAs, it has shown that there is
- Improvement in irrigation efficiency in 66 % WUAs.
- 34% WUAs have diversified their cropping pattern by growing wheat, sunflower, cornflower, soybean, sugarcane, banana, gram, orchards and flowers.
- Watercess recovery in 34 % WUAs has increased due to establishment of WUAs.
- The management grants and O & M grants are partially disbursed to 48 % of WUAs.
- As much as 31% of WUAs have balance amount at their disposal and accounts of 40% WUAs have been audited.

5.4 LEARNINGS

Some important lessons learnt are as follows:

- WUAs are generally formed in tail areas. For success of PIM, it is necessary that WUAs be formed throughout command area.
- WUAs are still reliant on the Government, for want of management and maintenance subsidy.
- It has seen that there is no sufficient increase in membership after formation of WUAs.
- In majority cases, canal systems are transferred without rehabilitation of the system. Also there is no fixed time schedule for completion of rehabilitation work, which is generally subject to availability of funds. The condition of canal many times restricts sustainable development of WUAs.
- The WUAs are registered under the Co-operative Act. As Co-operation Department is loaded with their own work, least attention is being paid on sustainable development of WUAs.
- WUAs have apprehension about securing due water quota provided in the agreements.

5.5 REASONS BEHIND SLOW PROGRESS OF WUAS

Some of the basic reasons for slow progress are given below:

- Canal system needs to be rehabilitated before transfer to a WUA. However, deferred maintenance due to inadequate O&M funds deteriorated the canal system, prolonging its transfer to WUAs.

- Farmers had a feeling that Government is completely responsible for supply of water to them and thus forgo any help in maintaining it.

- Lack of funds caused untimely or sometimes no disbursement of grants to WUAs slowed down the growth of WUAs.

  Inadequate training and capacity building of members of WUAs and lack of understanding and enthusiastic support from the Department officials causing meager progress in the objective of spreading the WUAs across the State.

5.5 CHALLENGES

Government of Maharashtra (GoM) has now made mandatory to supply water for irrigation through WUAs only. So far 2590 WUAs are registered on 875 Thousand ha, while 3295 WUAs covering 1064 Thousand ha are under various stages of formation. GoM has prepared Master Plan for formation of another 7500 WUAs on remaining 2.7 Mha area in coming 5 years. The real challenge however lies in making WUAs self-sustainable.

It is observed that impact of PIM is restricted to few success stories. It is our objective to upscale it without loosing its quality and impact. There are challenges in upscaling, some of which are as below.

5.6.1 Challenges in up scaling of PIM

- Simple procedure for formation of WUAs
- Time bound rehabilitation of canal system before transfer to WUAs
- Huge requirement of funds for rehabilitation
- Training and capacity building of members of WUAs as well as field officers
- Re-engineering of lower level management staff
- Political will and commitment of the Department
- Self-sustainable design of WUAs
- Conflict management among WUAs and with canal officers
- Monitoring and evaluation

5. REFORMS INITIATED BY THE GOM

The GoM has been pioneer in implementation of PIM. There are number of successful examples of PIM. The approach of Maharashtra has been gradual but convincing. During last 3-4 years, GoM has initiated a number of reform measures supporting PIM.

In July 2001, GoM has taken policy decision to supply water for irrigation through WUAs only (with a timeframe). The supply of water will be on bulk volumetric basis. The volumetric measurement of water for irrigation is in vogue in Maharashtra since 10-15 years. The farmers are well aware about volumetric measurement. Farmers have freedom to grow any crop within the water quota given to WUA.

The charges of water are also increased in 2001 to meet O & M of the canal system. The increase is almost 1.5 to 2 times of previous water charges. To clear arrears from farmers, innovative scheme has been launched. The participation of farmers is not only sought for management but farmers are involved in planning, construction of minors also. It has been made mandatory to form WUAs before construction of minors.

The GOM has also decided to set up the Maharashtra Water Resources Regulatory Authority (MWRRA) to regulate water resources within the State. It will facilitate and ensure judicious, equitable and sustainable management of water resources of the State.

6.1 MAHARASHTRA MANAGEMENT OF IRRIGATION SYSTEM BY FARMERS

To empower WUAs, the GoM has enacted the Maharashtra Management of Irrigation Systems by Farmers (MMISF) Act 2005.

6.1.1 Salient Features of MMISF Act

MMISF has various innovative provisions to strengthen the PIM initiative. The MMISF act lays down simple easy procedure for formation of WUAs. The registration of society shall be done by the Water Resources Department itself. Salient features of the Act are as follows :

- Water for irrigation shall be supplied to WUAs only
- Water will be supplied on volumetric basis
- WUAs have freedom of cropping pattern
- Adequate representation to tail enders and women members is provided in the management committee of WUA
- Time bound programme of completion of rehabilitation works before transfer to WUAs
- All landholders or leaseholders must be member of WUAs (unlike earlier 51% of landholders or 51% users).

6.1.2 Process adopted for enactment of the Act

The draft of bill has been prepared taking into consideration the best practices available in the PIM. The draft is discussed among users, NGOs, experts at various regional centers before translating it into a bill.

The bill was introduced in assembly for approval. Considering the importance of bill, joint select committee of legislative members of all major parties from both the houses is formed. The joint select committee has deliberated clause-by-clause provisions and suggested suitable changes therein. Any act should reflect the people's common feeling which make the act acceptable to masses.

The MMISF Act will go a long way in strengthening the PIM cause. The enactment of MMISF Act 2005 has cleared the way to go in for PIM in full swing.

6.2 STEPS TAKEN BY GOM TO STRENGTHEN PIM

Maharashtra has a long tradition of co-operative movement in the State. The co-operative movement has been very successful in finance sector (e.g. banking) as well as industrial sector (sugar factories). The co-operative movement is a way of life for everybody in Maharashtra.

There is consensus among all political parties to adopt participatory approach in irrigation management. The MMISF bill is thoroughly discussed with all party members of the legislature. Minister for the WRD has headed the committee and taken lead in forging ahead the PIM movement in the State.

In irrigation management, farmers have already welcomed PIM approach but it has not so far been adopted on big scale due to limitations discussed earlier. But with assured flow of funds for rehabilitation, an exclusive act for PIM on scene, there will be no difficulty in mass implementation of PIM. There are number of good examples of WUAs promoted and supported by field officers. Top level as well as middle level officers is convinced about PIM and there will be positive support from the Department's side.

GoM has taken a number of initiatives to facilitate effective and speedy implementation of PIM. Some important initiatives are as follows:

6.2.1 WUAs model

As described earlier, MMISF bill has taken utmost care to provide WUAs model, which will be self-sustainable and also have adequate authority to discharge functions smoothly. There will be a legal agreement between WUAs and competent authority, safeguarding due interest of WUAs with commitment to provide bulk water use entitlement. The appropriate powers of canal officers (Section Officers, Deputy Engineers and Executive Engineers) are delegated to WUAs as per provision of the bill. WUAs will now have to deal with only WRD for day-to-day functioning as well as, registration, auditing etc. WRD will provide full technical support in initial years to facilitate working of WUAs.

The adequate representation is being provided in managing committees of WUAs to members from tail, middle and head alongwith due representation to women. The WUAs will be allowed to keep certain portion of water charges for management, operation & maintenance of the canal system. The effort has been made to adopt best practices in this or other sectors within the State as well as in other states.

The bill provides clear and fair arrangement for conflict resolution among WUAs and canal officers. Due opportunity is given to aggrieved party to place their grievances before an impartial forum.

6.2.2 Effective communication with WUAs

An utmost care is taken in developing effective communication with WUAs. The dialogue between WUA and Department as well as with other WUAs is vital for success of PIM. Therefore it is planned to have workshop twice a year, wherein difficulties and possible solutions are discussed vis-a-vis WUAs, field officers and policy makers. The feedback of the workshop will be used for under taking suitable corrective measures in implementation of PIM.

It is also planned to publish newsletters fully devoted to PIM to appraise the developments taking place in PIM in different parts of the State. It will help in exchanging information as well as sharing experience in order to take this movement ahead. It is also under active consideration to institute an award for best performing WUAs to appreciate their effort and motivate others to work better.

6.2.3 Training and Capacity Building

Training and Capacity Building plays crucial role in taking ahead the PIM movement. Water And Land Management Institute (WALMI) will act as nodal institute in training, which will impart training to officers, member of WUAs, Trainer of Trainers (TOT) and will also play role of mother NGO. As WALMI infrastructure may not be sufficient to conduct training of field officers as well as members simultaneously. It is proposed to carry out training with trainers' team consisting of experts from irrigation, agriculture and social sciences. These trainers' team will be trained at WALMI, which in turn trains functionaries and field officers at field level. The training activity is designed as continuous wherein training will be provided as per needs and with the development of PIM. It has also been planned to take help of NGOs to nurture the WUAs and facilitate WUAs in discharging their functions.

6.2.4 Maharashtra Water Sector Improvement Project

To carry out rehabilitation of canal system in time bound manners, the GOM has taken up Maharashtra Water Sector Improvement Project (MWSIP). The MWSIP envisages transfer of management to WUAs after adequate rehabilitation. To inculcate ownership among farmers, farmers have to contribute 500 Rs. /Ha in rehabilitation of the canal system. The system will be rehabilitated to carry the designed discharge, through the canal and disnet.

6.2.5 Monitoring and evaluation of WUAs

Last but not of the least importance is, monitoring and evaluation of WUAs in the State. It is very important in case of any developmental activity, particularly in social development, wherein timely monitoring evaluation and undertaking corrective action is necessary. If right action is not taken at right time, there will be a lot of damage to the development accomplished and sometimes it would be difficult to move ahead. Therefore, it is proposed to have monitoring and evaluation through third party directly reporting to decision-making level. The consultant will collect information through well-designed questionnaire and through Management Information System. The corrective action will be taken based on timely feedback. A co-ordination committee is established, consisting of WUAs from different regions, NGOs, policy makers and few field officers, to facilitate working of WUAs. The coordination committee will meet at least once in a quarter.

7. WAY AHEAD

The GoM has also enacted Maharashtra Water Resources Regulatory Authority Act to regulate water resources within the State. It will facilitate and ensure judicious, equitable and sustainable management of water resources of the State. It provides water use entitlement to individual farmers. Conferring water use entitlements to individual farmers will be path-breaking development in irrigation sector in India. There is also a provision of transfer of water use entitlements for maximizing irrigation use efficiency. Therefore, MMISF Act coupled with MWRRA Act will consolidate PIM and will ensure the sustainable development and management of water resources in the State.

SUMMARY AND CONCLUSIONS

Maharashtra has long tradition of Participatory Irrigation Management. In nineties, Water Users Associations (WUAs) are formed in irrigation projects on pilot basis, but as of now WUAs are formed in length and breadth of the State. A study was conducted to evaluate performance of WUAs functioning in the State. The aim of the study was to find out improvement in performance before and after transfer of irrigation management to WUAs. The study has provided insight into hindrances in functioning of WUAs and measures to improve its effectiveness, which in turns improves the performance of irrigation projects. It reveals the reasons behind the slow progress and also highlights important learning and challenges to upscale PIM in the State. GoM has initiated series of reforms to strengthen PIM. A stand-alone act (MMISF Act - 2005) has been enacted to provide legal backing to WUAs. The water for irrigation will be supplied volumetrically through WUAs only and there will be legal agreement between WUA and competent authority. The act adequately empowers WUAs to discharge their functions with delegating appropriate powers of canal officers to WUAs. The State has gone further in providing water use entitlement to individual farmers and establishment of independent water resources regulatory authority to ensure judicious, equitable and sustainable management of water resources of the State.

It is observed that Irrigation management transfer improves the service delivery as well as financial performance of the Project. It is not time to discuss whether to go in for

PIM or not, but to up-scale it without loosing its quality and impact. There is need to have committed support from WRD and timely efforts to build WUAs to shoulder the responsibility. It is also essential to strike harmony between goal and efforts of Govt., NGO and Community.

The Maharashtra case study would provide insight into important aspects of PIM and possible measures to strengthen WUAs movement. Though Maharashtra approach to PIM is gradual, but with reforms in place and changed mindset of officers of WRD and farmers, PIM could lead to sustainable irrigation management.

FORMATION AND DEVELOPMENT PROCESS OF PARTICIPATORY IRRIGATION MANAGEMENT IN QAZVIN AREA

A. Ghasemi[1], S. A. R. Razavi[2], A. Yousefi[3], A. Lashgari[4] & M. M. Rahmani[5]

ABSTRACT

Since last fifty years, gradual progression in management style of irrigation and drainage systems supported by promotion of people's participation in management trend has faced the government-oriented or hindering mechanisms to critical challenges at global scale. Genesis of this mind-set could largely facilitate evolution of change management through the four-stage process including: diagnosis, denial, cooperation and participation.

The largest infra-structural establishment of Qazvin was created during 60s and 70s. It enjoys 1200 km. concrete canals bearing conveying capacities of 30 m^3.

The network imitates a telescopic model in operation with hydro-mechanical diversion and checks (Amil) installed at its upstream. The Irrigation Management system in Qazvin (QIM) also follows full public governance as being experienced everywhere across the country. This traditional management, parallel to over-dated structures has left nothing but a depreciated and inefficient network in Qazvin.

A holistic plan for capacity building and empowerment of local farmers was founded in the province to develop a participatory management and promote due changes towards optimum utilization and maintenance of the network. The initiative is reliant on a tree-shaped model and consists of: farming groups, water users associations, unions and their apex Federation at provincial level. Upon direct election of farmers' representatives and formulation of legal instruments, managerial and maintenance affairs in main and lateral canals were gradually transferred to the local clients.

Presently, many commitments encompassing structural rehabilitation and water distribution have been shifted to the farmers in Qazvin, followed by logistic and

1- M.Sc. in Irrigation Structures, and Managing Director of Qazvin Irrigation Management Co. (QIM), & Initiator and Executive of Qazvin Participatory Irrigation Management Project. Address: Shahid Bahonar Bulvd., Qazvin, Iran. Tel: +98281-2233-187, Email: ghasemi_ali2@yahoo.com
2- Director of Planning Affairs in QIM Tel: 09127809890 Email: S-amirrezarazavi@yahoo.com
3- Director of Int'l Affairs - Dept. for Extension and Farming System, Ministry of Jihad-e-Agriculture (MOJA) Tel: 09123394834 Email: intyousefi@yahoo.com
4- Director of Engineering Affair in QIM, Tel: 09121825791 Email: Ar_lashgari48@yahoo.com
5- Director of Technical Affairs in QIM, Tel: 09122827745 Email: M_MehdiRahmani@yahoo.com

administrative works handled by private sectors. Dynamic involvement of the young men and women at managerial and technical levels scattered at WUAs branches or Federation posts remarks for outstanding aspects of the PIM system in Qazvin. To date, the mode applied for creation of CBOs (community-based organizations) and legislation of NGOs in terms of Water Users Association (WUAs) in Qazvin, generates a national pattern over the state.

Keywords: Participatory Irrigation Management (PIM), Participation, Irrigation Management Transfer (IMT), Empowerment, WUAs, NGOs, CBOs

1. INTRODUCTION

In addition to professional mind-sets, well-designed policy and a 20-year perspectives (National Development Horizon in year 2022) supported by National Constitution (Article 44), have demonstrated a clear horizon for NGOs' development especially in the process of Participatory Irrigation Management (PIM).

Presumably, fundamental studies would contribute to discover the reasons behind the poor performance of irrigation operations, as well as, low productivity of agricultural activities and their barriers. Lots of ongoing challenges and inconsistencies in irrigation networks are referred to mismanagement of the related systems.

Shedding light on the public bodies' function, removal of parallel duties, simplifying operation cycles, developing accountable management system, and generating a committed management to mobilize peoples' participation, would greatly create a spring board for organization and empowerment of farmers' communities , and ultimately, for changing the traditional water management at national scale.

The target area intrudes the Taleghan River Basin bearing an extension of 1000 km2, containing the Qazvin irrigation network with 80,000 (ha) surface areas. Qazvin Development Project (QDP)[1] has foreseen to distribute an average discharge of 460 m.m3/y into 278 (m.m3) for agri-business purpose and 20 m.m3 for artificial recharging of water- tables in Qazvin plain. The grand and multi-purpose Project has provided noble opportunities for provincial development, particularly in cultural, social, infra-structural and occupational dimensions just next to political and economic pole (Tehran) of the country. To this end, various and large production enterprises been so far established which reinforce the basic changes in the area.

There emerged also several challenges and disparities during 30–year management process of the irrigation network in Qazvin, mainly owing to the following reasons:

- Poor utilization of the network's structures;
- Off–service status frequently reported from hydro-mechanical Checks, C.H.O, and Turn- out gates;

1 -Formerly registered as "Ghazvin Development Project-GPD" by the World Bank

- Illegal offending in the network witnessed by creating numerous farm outlets as well as unauthorized wells; and
- Fatal events due to frequent fall of the vehicles or people into the canals.

The overall 5-year plan adopted by Qazvin Irrigation Management Co. (QIM) could organize 30,000 local farmers' under 158 Irrigation associations and 9 unions dominated by an apex Federation. Since 2002, organization and transferring network management to CBOs (Community-Based Organization) deserved central priority and agenda by QIM, which fortunately, led to successful implementation. This initiative was basically accepted and supported by the Ministry of Jihad–e–Agriculture, and the National Water Resource Management followed by assignment of QIM as the national pilot for PIM commencement.

2- CHANGE AS DRIVING FORCE IN DEVELOPMENT

Organizations require fresh and dynamic thoughts and approaches for their existence and progression. For improving the living standards in the evolving pace of the current status, it is inevitable to emphasize on identification of changes in the surrounding environment, as well as, derivation of adequate responses to new conditions.

Innovation and creativity account for core aspects of competent organizations and individuals. The initiative seriously stresses on educating potential managers as the core elements of continued improvement and builders of due capacities for qualified man powers to undertake new commitments. Meanwhile, certain technical groups have to be shaped to liaise with public and private sectors .To realize this principle, proper ground should be paved for shaping specialized groups at public or private sectors. Political and social forces shall accelerate or hamper development of new organizations. Recent changes and their sustainability happened in socio-economic and political settings, relies on governmental efforts bestowed to ongoing institutional and thinking reforms.

Identification and examination of bottlenecks and the factors behind certain misunderstanding, as follows, assumed for the initial steps to attract the beneficiaries' confidence:

I. Gaps or inconsistencies in rules,

II. Mispromising of some authorities,

III. Inefficiency of few executive bodies, and

IV. Poor reaction of judicial system against the offenders.

The existing executive or administrative bodies, particularly, setting fresh cooperation and interaction with farmers, would subject to change through enhanced capacities and creativities amongst the players and farmers of the same area. Qualitative concept of "competency–oriented influence" consists of three elements including capability, accountability and morality represent. If farmers & beneficiaries control the above mentioned condition, it will be effective in the process of empowerment and it will develop CBOs.

3- EXECUTIVE PROCESSES OF PIM IN QAZVIN

The Participatory Irrigation Management (PIM) initiative started its operation since 2002, using local potentials within a 3-year schedule and three general stages: first stage: the company's bound, second stage: Qazvin province bound, third stage: national level. Key characteristics of this idea focus on setting an inter-communication among all institutional processes, in a sense that, the precedent stages have to be well–established in the following years.

Organization of the WUAs in Qazvin plain followed on the identified local requirements and specifications. This task has to get built upon the speed and ease in detection and meeting the needs of every area, and to wards this target, the initiative confronted diverse cultures and sub-cultures with varying aspirations raised over the vast plain in Qazvin.

3.1. FIRST STAGE:

This stage comprised of confidence–building, system–development, planning, data-banking and processing within the QIM premises (staff and target clients) during 2002-03.

The most significant prerequisites for development of participation in different activities, spell out for in-depth belief and basic support dedicated by top managers. The proposed legal management system in the network entails the following key measures:

1- Collecting the beneficiaries' views and consulting them to reflect the barriers and inconsistencies;

2- Setting full–coordination in all planning and decision–making processes;

3- Examining the collected views and perspectives followed by offering useful suggestions;

4- Directing general mind–sets toward improvement of social, cultural and economic affairs; and

5- Collaborating in the processes of execution and supervision of related techno–economic plans.

Organization of local irrigation management, as a reliable bed for transferring possible commitments, relies on general culture and technical background of the individuals concerned, and will put into practice through attracting the beneficiaries and building reciprocal confidence. Designing local irrigation management was tracked by consolidating common hierarchical interactions and ties, followed by election of managers and practitioners at different levels within the system.

Different tiers of election and representatives are shown in diagram 1.

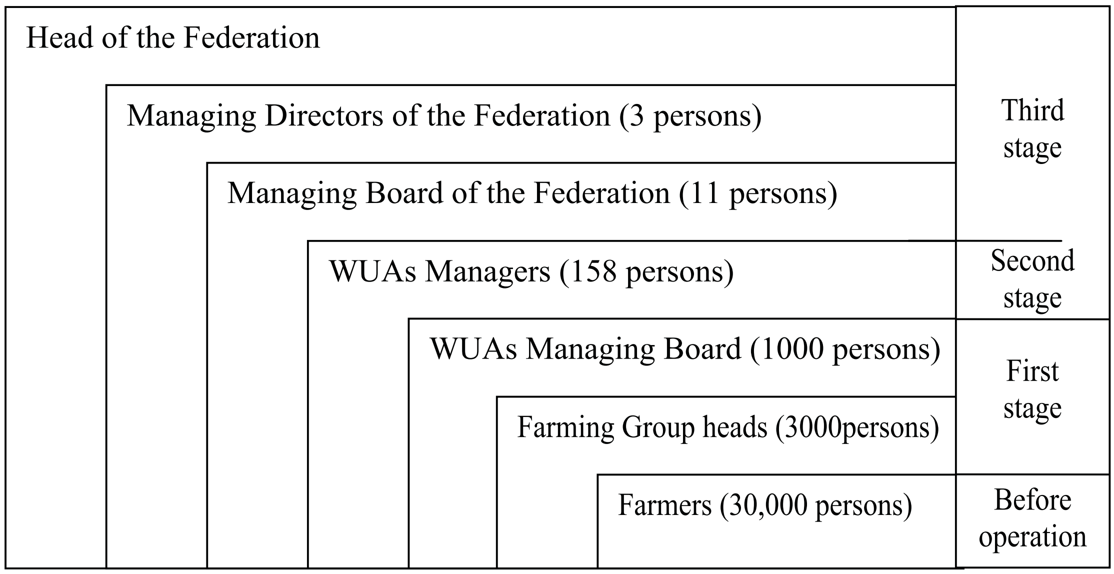


Diagram 1. Election and institutionalization for PIM development in Qazvin

Various programs been foreseen and fully implemented in this stage including:

- setting flow–chart cycle;
- formulating IMT model;
- Collection of basic information as statistics on lands, landowners, and water needs;
- cropping patterns of the area under channels III;
- Derivation of due indicators for information classification;
- Encoding the joint turn–out spots (6 digits);
- planning on due methodologies and matrices for election of farmers' representatives in neighboring plots (100 & 1000 ha.);
- Water–logging in combined wells; and
- drafting typical agreements for water supply and network exploitation based on 158 turn-out points in channels III

3.2. SECOND STAGE:

This stage encompasses coordination, organization, institutionalization, and establishment of local irrigation management especially on canals II, completed in Qazvin during 2003-04? The operational range of the IMT stepped beyond the QIM and even covered key executive institutions at provincial level. Other important measures, as follows, were also taken into account and completed during this stage:

- Registration of 30,000 farmers from 88 population centers;
- Assigning the managers in farming blocks;

- Encoding the farmers' representatives ;
- Filing the related 158 WUAs and dispatching them to the provincial Office of Cooperation for certification;
- Transacting the file containing Article 5 of the Act on "optimum use of agri–water for WUAs" to provincial Water and Agriculture Authorities;
- Concluding proper agreements on water supply and utilization; and
- Forwarding financial issues and order registration affairs for WUAs' operations on canals II.

Meanwhile, the procedure for structuring the Local Irrigation Management pursued the following steps:

(i) Planning for viable and comprehensive participation of local users in exploitation and maintenance of the network, in line with, deserving due entitlements for CBOs and WUAs.

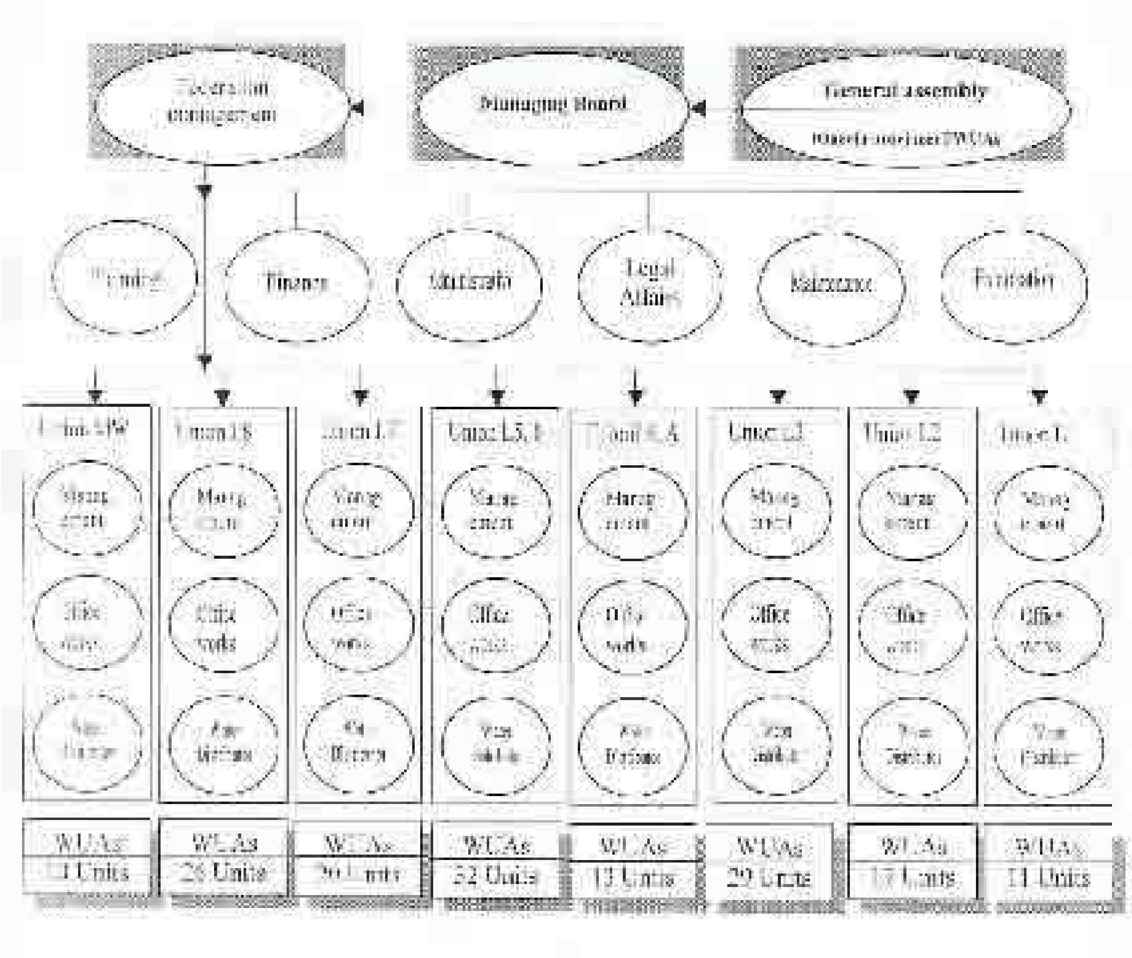
(ii) Volumetric submission of water to farmers' representatives at specific points, and based on approved cropping pattern i.e. cereals 50%, summer crops 25%, and fallow 25%.

(iii) Formatting and prioritizing certain tasks and operations as indicated in Table 1 below:

Table1. Structural and organizational sequences of PIM in Qazvin

No.	Farming unit	Farming area (ha.)	CBOs' working domain
1	Plots	10-20	Farmers' Representatives
2	Groups	20-100	Group-heads
3	Blocks	100-1000	WUAs
4	Area	1000-10,000	LIM/ Distributors
5	Agricultural Pole (Qazvin plain)	Gross 80,000 ha. Net 60,000 ha.	Apex Federation

Following shows the flowchart of the water users' arrangement in Qazvin which was approved and operated by General Assembly in 2005:



"Diagram2". Flow- chart of the Federation and its lower tires in Qazvin plain

3.3. THIRD STAGE:

This stage included activation of provincial Federation, regulation of inter-relationships between the local offices and unions, rendering technical services, transferring the shares, and entrusting the ownership with partial failure, during 2004-05? This stage was partially geared to national level and hence, its completion relies on new policy and legislation to be reformed and circulated later on.

During this stage, few obligations adopted, as follows, but not yet covered due to certain legal or administrative obstacles standing far beyond the QIM liabilities:

- land surveys and cartographic operations (Cadastre Mapping) over the WUAs domains;
- Supplementing the available documents by precise re-examination of the network's segments and status;
- Preparing official minutes on transferring of channels III and IV to the WUAs ;
- Transferring the QIM shares to the new local users;

- Refunding the water rate in favor of network rehabilitation; and
- Official devolution of the canals ownership to the WUAs.

In the third stage, the QIM, as the planner and operator of this initiative, could implement possible mandates as described below:

- Expansion of water-ordering registration and checking the requests across the water rights;
- Rendering water sale and services at local irrigation management offices (on Canals II); and
- Activation of the Federation for practical involvement of the farmers in operation and maintenance of the network.

4. PIM DEVELOPMENT IN QAZVIN AND ITS IMPSCTS

4.1. TRAINING THE STAFF AND WUAS MEMBERS

Normally, administrational systems together with working cycles and methodologies always tend to retain the ongoing and daily commitments.

Training and disseminating the new approaches developed by top managers of executive institutions play a basic role in promotion and change of such passive system. To this end, appropriate training courses were conducted towards up-scaling knowledge and potentials of QIM and Federation staffs. The foregoing courses were designed and practiced at large scale and in cooperation with other organizations. Following are the courses convened by QIM during the past 4 years:

- Training course on PIM development implemented as group–works for managers, experts and technicians, followed by weekly meetings participated by QIM, Federation and unions' Managers. As a whole, 36 work–groups were formed on organizing suggestion system.
- Training course on utilization and maintenance of the irrigation system which run for two weeks and targeted some QIM and Federation staffs to raise their knowledge and proficiency.
- Training course on social prevention and protection which aimed at prevention of offending in the network area, and conducted in collaboration with provincial judicial authority for 170 participants of QIM and local users.
- Training course on IMS (quality, environment, professional hygiene and immunity), which operated in cooperation with R.W.T.U.V Iran Co[1]. Of Iran and focused on promoting internal auditing of IMS for experts and technicians in QIM and Federation.
- Training course on First Aids which realized to make the staffs and members prepared against probable events during operation or even beyond the network

---

1- A German agency responsible in certifying certain standards and qualification in Iran limits. This course was carried out for 40 hours in cooperation with National Red Crescent Organization at A and B levels in 2006.

- Training course on machinery operation and maintenance which launched for 40 hours to upgrade the drivers' competency at Alborz Industrial Complex.
- Training course on fire-extinguishing practices performed at QIM to expose QIM and Federation staffs to fire suffocation methods in assistance with provincial techno –vocational organization and Fire- Station in 2006.

It seems convention of successive training courses, as well as, participatory working cycle for proceeding current and developmental businesses have underlined the PIM success in Qazvin.

4.2. GENERAL ACTIVITIES AND INFORMATION DISSEMINATION

Active participation at national/international conferences related to management of irrigation and drainage, and exchanging the findings have always been regarded as crucial priorities in the QIM.

To this end, the Company developed and activated its web-page in 2005, followed by another page for the Federation in the next year. This web station now stands for the first e-news forum of non-governmental irrigation management across the country.

4.3. Roles of the youth and women in the project

Creation and fixing occupational status together with self–confidence would contribute in rising managerial pace and impacts of the youth and women communities. They are so qualified and strong that can jointly launch continuous struggle against poverty and construct their homeland. Many of them shared in development with their intrinsic motivations and powers.

Simultaneous with the Associations or Federation operation's in Qazvin , and gradual commitment in the largest irrigation network of the area, numerous empowered men and women stepped in and undertook crucial functions at medium or high positions. They occupied key professions as managing directors, accountants and planning managers in the Federation or the local irrigation offices. Presence of female top managers next to the male authorities in agricultural CBOs, has generated well–structured organizations for enhancing the irrigation management system with appreciable achievements at provincial scale.

To date, the gender ratio governing on employed experts and technicians depicts a prevalence of the females to males (57%). They also possess a reasonable ratio (40%) in general occupations distributed at various services in Federation and the local irrigation offices (Diagram 3)

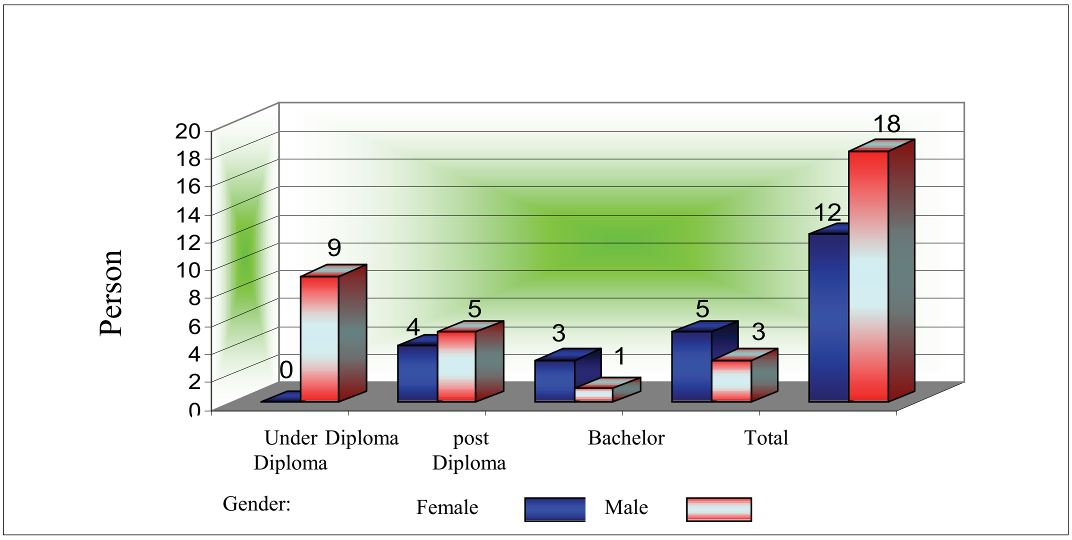


Diagram3. Gender comparison on WUAs staff in Qazvin

4.4. Impacts of PIM implementation

The PIM in Qazvin was set into fruit through:

- Planning for balancing or reduction of incompetent man powers;
- Transferring subsidiary functions to external operators; and
- Paving the way for WUAs' participation in utilization and maintenance of the network ;

This initiative generated authentic outcomes, as follows, which gradually extended to target beneficiaries:

1- Facilitation of office works or field operations through narrowing the network functions;

2- Down-sizing the public interventions and hence, balancing the number of staff at QIM;

3- Reduction or even stopping the users' approaches to public offices, and in particular, to QIM by 95%;

4- Introduction of local irrigation management in channels II, III and IV and remarkable save in people's cost and time;

5- Devolution of passable functions to local people and gradual substitution of public sector by CBOs;

6- Defending of farmers' rights according to the proposed conical chart of accountability;

7- Transparency of interactions between the farmers and governmental bodies , and possibly reduction of organizational offending and corruptions;

8- Separation of responsibilities and equitable distribution of water and expansion of social justice;
9- Reduction of water losses and seepages in favor of promotion in irrigation performance;
10- Reflection of useful comments for improved utilization and maintenance of the network;
11- Planning for controlling and removal of unauthorized or non-standard turn–outs;
12- Saving in water consumption for its subsequent impacts on exploitation and control of Qazvin water-catchment.
13- Raising productivity through fixing, maintaining and utilizing the network;
14- Setting minutes on submission of the network and its segments followed by bedding for essential protection of national assets.
15- Confirming the theory on effectiveness of participatory irrigation management (PIM) or consultation in Iran ; and
16- Creating employments for experts or technicians at Unions and Federation scales.

5. RECOMMENDATIONS

5.1. TRANSFERRING THE FUNCTIONS TO THE LOCAL CLIENTELE

Regarding the incredible progressions made by PIM in Qazvin, it is strictly recommended to apply public funds or subsidies in harmonization with the Federation's opinions. There seems reliable stand provided to refund the water charges for required repairs and maintenances to be handled by Federation.

5.2. BASIC STUDIES AND INFORMATION DISSEMINATION

So far, extensive studies made to yield proper strategies for devolution of network's functions and leadership to CBOs shaped in Qazvin. Now, its time to disseminate gradual information on PIM to attract attention and assistance from all players and practitioners involved. Besides, emphasis should be a attached to disclosing each and every corner of the initiative, followed by blocking anymore parallel studies and costs on IMT approaches. Along this trend, certain supplementary field-oriented surveys are also identified for possible convention and analysis.

5.3. SEPARATION OF MANAGEMENTS IN WATER RESOURCES AND UTILIZATIONS

Scholars highly stress on distinction of supplying and utilization of commodities owing to the core differences seen in their natures. The reason strongly stands behind formation of various production as well as utilization bodies in major fields as oil , gas, electricity, tele-communication, "water and sewage water" , etc. , whereas , the water sector still suffers from certain intermingled affairs in managerial fields, and pending for rational solutions to be outlined by eminent experts or managers. It seems, however, that the promising scenario adopted by electricity sector (comprising of separated supply and use divisions) shall be duplicated for water sector, as well.

5.4. FULL DEVOLUTION OF COMMITMENTS TO WUAS

It is suggested that all commitments foreseen in micro–water allocation to agriculture sector, followed by water resource protection, **network** and its premises control and supervision are handed over to provincial water utilization body. Presumably, few modifications applied to water management system of the M.O.E, shall provide a tailor-made platform for such switch–over in obligations.

6. REFERENCES

1. Archives, Provincial Office of Jihad-e-Agriculture- Qazvin ;
2. Archives, Qazvin Irrigation Management Co. (QIM)
3. Aivani, Sayeed , Mahdi PH.D. 1995. “General Management”, Nei publication. 408 pages
4. Arvin-Pajouh Research–Cultural Institute 2000. Exposure to Participation System as Infra-structure for World and Islamic Advanced Management. Publication of Oil Ministry. 280 pages.
5. Bayani P. Ofrecio. Nov. 2005 Participatory Development and Management: A Corerstone of Philippine Irrigation Program, Tsukuba Asian Seminar, Japan
6. Central Secretariat of Urban Water Management. 2005. Tehran, Promotion of Women’s Role in Water Management, 238 pages.
7. Ghasemi, Ali. 2005. Tehran, Iran Regional Center on Urban Water Management - Tehran Workshop on Women’s Participation in Water Management, (proceeding)
8. Morhead, G. & Griffin, R. 2003 translated by Alvani, Sayeed, Mehdi PH.D . & Memarzade, G.Reza.PH. D. 2003. Morvarid publication. 571 pages
9. Proceedings of the 11th Conference of the National Committee of Irrigation-Drainage in Iran. 2003. No. 83
10. Sustainable development in a dynamic world: Transforming institutions, growth and quality of life. 2003. The World Bank

STAKEHOLDER VIEWS ON THE MIRAAB SYSTEM FOR PARTICIPATORY MANAGEMENT OF MODERN IRRIGATION SCHEMES IN IRAN

Najaf Hedayat[1] and Keith Weatherhead[22]

ABSTRACT

Rural reforms in Iran have changed the land holding regime, cropping pattern, and market system. A study of stakeholder views on the modern Dez and Moghan irrigation schemes has suggested farmers and extensionists agree that the existing canal management is not sufficiently responsive to the new challenges of agriculture in the post-reform era, and that a more participatory management structure could help resolve the problems in water delivery. Iran already has a long-standing and successful model for participatory farmer management in the millennia-old Miraab system (*Shaarebin*) used for managing the Karezes and Qanats in the arid and semi-arid regions of Iran. This would appear to be a suitable model on which to build.

The survey responses indicated that all three stakeholder groups (farmers, extensionists and water agency staff) would support the implementation of a management structure based on the Miraab system. All three groups indicated they thought that the government would support such a change. Detailed interviews, however, suggested that farmers and extensionists thought some water agency staff would resist its implementation as a threat to their existing authority.

The research confirmed the importance of consulting different stakeholder groups, who might have different attitudes and perceptions of the problems and potential solutions.

Keywords: Stakeholder views, Participatory management, Mirhaab, Iran

INTRODUCTION

Agriculture is a vital sector of the Iranian economy contributing about 25% of the GDP. It employs about one third of the workforce in a country where there is a high rate of unemployment among the younger generation in rural areas (MoJA 2002). The Third FYP (1999-2004) aimed at achieving an annual expansion of irrigated land by 3.8%

1- Islamic Azad University, Dezful, Iran;
2 - Centre for Water Science, Cranfield University, MK43 0AL, UK. Tel +44 1525 750111 k.weatherhead@cranfield.ac.uk

with a corresponding annual increase of 4.4% of water supply for agriculture. However, water management in many of the schemes is poor. It is mostly conveyed, controlled and delivered through unlined canals (*Anhaareh Sonnati*), resulting in its rudimentary and wasteful use (MoJA 2002). The MoJA estimated the application efficiency of about 30 % in the Dez and 20% in Moghan. This causes of poor farming and adverse environmental impacts.

The Dez and Moghan are the two largest modern irrigation schemes in Iran. They were originally designed to be operated by the state agencies and provide services for predominantly large agribusinesses. A major change in rural Iran after the Revolution in the late 1970's was a land reform programme redistributing some of the former agribusiness' lands among the small landless farmers. This was followed by a change in the cropping pattern that ideally necessitated a more flexible and reliable water delivery schedule than original rigid rotation regime was able to meet.

Problems that have been observed and documented by various sources (e.g. MoJA 2002, Keshavarz 1993), including those observed by the lead author during his professional field visits, include:

- Land fragmentation and tenure system in both schemes.
- Uneven irrigation due to poor land levelling.
- Environmental problems such as soil salinity, water logging and drainage problems (particularly in Moghan) due to poor O&M of the canals and imprudent on-farm practices.
- Poor water conveyance and control systems, and hence poor delivery at the farm gates, arising from inappropriate design and inadequate or deferred maintenance of the hydraulic structures.
- Lack of transparent authority over canal management, causing poor communication and cooperation between various stakeholders.

Direct management of the water distribution system by the state agencies appeared to have placed the farmers on a dependency situation and denied them the opportunity to participate in their O&M.

THE MIRAAB SYSTEM AND PARTICIPATORY FARM MANAGEMENT

The Miraab system is a traditional Iranian water management institution that was used for operating and maintaining the Karezes and Qanats in arid and semi-arid regions of the former Persian Empire, including the location of present Iran. Until recently, these artificial subterranean hydraulic structures were widely used to supply water for irrigation and domestic use, not only in the central desert regions but also in some semi-arid parts of Iran such as Dezful, where the Dez irrigation scheme is located (Behnia 1988). The Qanats and Karezes, of various lengths and shapes, were exclusively operated and maintained by private owners (most of whom were members of the farming community) through their representatives known locally as the *Miraabs, Aabyaars* and *Tilmaaj* (Malakqasemi 1996).

The Miraab system was basically a bottom-up water management model whose operational principles were based on the service concept. In other words the needs of water users (e.g. efficient and reliable service delivery) within a given resource availability determined the ways in which the Miraabs operated and maintained the system. Their self-sufficiency in managing all the operation and maintenance (O&M) duties of the Qanats was assured by direct labour or financial contributions of the water users. In earlier times, the feudal landlords generally made their contributions in cash or crops, whereas farmers either offered direct labour or a package including labour, crop and cash. Certain farmers traded their water rights and devoted themselves full-time to the O&M duties in return for wages. Still others used the *Nizaameh Moshaaee*, a land pooling system for crop sharing with their neighbouring farmers, and rotated the O&M duties and farm works among themselves.

The Miraabs had responsibility for making decisions on all aspects of O&M, including. collecting water charges and solving conflicts over water allocation, but were ultimately accountable to the *Showrayeh bahrebardaraan* (the supreme Miraabs council), which represented the whole farming community.

Although the Qanat system is an old civil engineering concept, the Miraabs (as major operators and users) recognised the importance of introducing modern technology to meet the water requirements of their beneficiaries. The Qanat operators, through the Miraab system, have begun to incorporate modern design concepts such as the construction of concrete dams along the underground conveyance galleries in order to store water in the pools when the demand was minimal. They have also installed some heavy-duty pipes and valves in certain Qanat networks for more efficient water control, conveyance, and distribution. They have recognized the benefits of introducing modern maintenance techniques and better materials to make the operations simpler and the use of labour and financial resources more efficient.

The indigenous Miraab system played a key role in sustaining the rural structures and livelihood of the farming community, for example in the central desert regions of Iran such as Ardekan and Yazd (Dehqanpoor 1999). This integrated approach to water management is suggested as a more cost effective and sustainable model for the management of the surface irrigation network.

STAKEHOLDERS' VIEWS

Stakeholders' views were used to investigate the water delivery problems and their causes on the Dez and Moghan irrigation schemes, and then to investigate their views on alternative management systems. After preliminary field visits, four workshops were organised to identify the main issues. A survey was then undertaken of 100 farmers, 50 government agricultural extension officers and 50 water agency staff, augmented by 36 interviews.

The major problems of water delivery relevant to the Dez and Moghan were identified by the workshops as inequitable allocation, inflexible supply, group conflicts and adverse environmental impacts.

However, there was a significant difference in perceptions of the stakeholders surveyed n the nature and sources of the water delivery problems. The farmers and extensionists perceived inequity and inflexibility due to poor O&M in the main and secondary canals as the most important water delivery related problems. In contrast, the water agency staff regarded group conflicts over water allocation and adverse environmental impact, due to mismanagement of the tertiary and quaternary canals as well as poor on-farm practices, as the most important. Notably, the farmers and extensionists had similar views on all issues except on water charges, where the extensionists (agreeing with the agency staff) thought that it would be impossible to improve the water delivery without increasing the charges. In contrast, the farmers thought that higher charges alone would not help, because the problems lie with inadequate design of the hydraulic structures and the present inappropriate canal management system.

The perceptions of respondents on modernization options varied. The farmers and extensionists regarded neither purely technical nor purely non-technical changes as adequate. The perception was that the farmers, extensionists and the agency staff, in that order, would support an integrated Miraab system as an appropriate management option. Although the survey responses suggested that all the stakeholder groups would support the Miraab system, the responses from the interviewees suggested that that the majority of the farmers and extensionists thought the senior water agency staff would resist it. The farmers and extensionists alleged that the agencies' resistance was linked to their anxiety of losing authority in canal management. The response of the agencies was that they were willing to support the change but were doubtful of its chances of success, because the extensionists have not yet prepared the farmers to take up the new challenges. All three-stakeholder groups regarded the central government's support for the change in the present system as crucial, and in their view it would be forthcoming.

CONCLUSIONS

The Miraab system is an indigenous farmer-managed system that offers a viable alternative to the present state management system. All the stakeholder groups surveyed indicated they would support its introduction, though some doubts were expressed in interviews about senior water agency staff.

It is suggested that farmer organizations should take the government's interest in irrigation management transfer as a window of opportunity to take up the stewardship of, initially, the tertiary water distribution system. They should use their indigenous knowledge to achieve the flexible demand management required for viable modern farming.

The commitment of farmers and support of other stakeholders are both crucial for success of the Miraab systems in the new working context. Successful management of the tertiary canals would be a good start for the ultimate establishment of the full farmers' stewardship of the main and secondary canals in the future.

REFERENCES

1. Dehqanpoor, M.R (1999). Qanats as the blood shrines of the Yazd croplands. A report (in Persian text) prepared for Soil and Water Management, Yazd Provincial Agricultural Department, Iran.

2. MoJA (2002). Managing water in irrigated agriculture. A text in Farsi published by the Technical and Specialist Training Group, Department of Technical and Infrastructures Affairs, Ministry of Jihad Agriculture, Iran.

3. Keshavarz, M.A. (1993). Improvement of the farm level infrastructures. A report in Farsi prepared for the Deputy Ministry for Infrastructure Affairs. Ministry of Agriculture, Iran.

4. Behnia, A. Sadeqiattaar, M and Kaveh, F. (1993). Irrigation efficiency under the Dez command area. (An unpublished report in Farsi).

5. Malakqasemi, D. (1996). Water Policy in Iran. A report prepared for the Deputy Ministry in Technical and Infrastructure Affairs, MOA, Iran.