

# PERFORMANCE ASSESSMENT OF IRRIGATION NETWORK CONSTRUCTION (CASE STUDY: KACHURESTAGH COOPERATIVE)

## EVALUATION DE LA PERFORMANCE DE LA CONSTRUCTION DU RESEAU D'IRRIGATION (ETUDE DE CAS: COOPERATIVE DE KACHURESTAGH)

Pantea Rahbari<sup>1</sup> and Mohamad Afsharasl<sup>2</sup>

### ABSTRACT

*In the last decades, widespread efforts were made for water resources development in Iran. As a result, irrigated area and productivity have substantially increased. As a national policy, the Jihad Agriculture Ministry has introduced production cooperative association in some areas with a view to increasing irrigation efficiency, encouraging land renovation, mechanizing agriculture and modernizing the infrastructure.*

*In this research, performance assessment of renovation and modernization activities are studied in Kachurestagh production cooperative association. Comparison between conditions before and after (present situation) network construction are also studied in this research in order to evaluate different aspects of functioning of the associations such as human power, operation and maintenance systems and their social evolution, status of resources and facilities, productive activities, agriculture economic, supporting services and agriculture management.*

*Kachurestagh production cooperative association located in Rigestan village, Isfahan Province was established in 2000. The Irrigation and Drainage network of this association were studied in 2002 by Isfahan Jihad Agriculture Ministry. The principal points of this study were analyzing of socio-economical structures, water and soil operation systems in both aspects of agriculture and none agriculture.*

*In the study area, chemical pesticides were applied in ample quantity without any control which is harmful for environment, but after renovation and modernization, the use of pesticides are*

1 Responsible expert of Irrigation and Drainage Department, MAHAB GHODSS Consulting Engineers. Tell: 021- 23964952 Fax: 021-22276487.  
E-Mail:pantea.rahbari@gmail.com

2 Project manager of Irrigation and Drainage Department, YEKOM Consulting Engineers. Tell: 021-82116448. E-mail:m.afshar@yekom.com

*considerably controlled. The main water resources in this area are wells, which were used for Irrigation before network construction in unscientific manner, causing water table decline. But after renovation and modernization plan this trend could be managed.*

*The Irrigation efficiency showed a moderate upward trend from 36 to 42 per cent due to renovation and modernization. The cultivated area increased from 630 to 834 ha during these years. The benefit to cost ratio is around 1.04 which is economically viable.*

**Keyword:** Assessment, Environment, Irrigation network, Modernization, Production Cooperative, Renovation

## RESUME

*Dans les dernières décennies, des efforts étendus ont été faites pour le développement des ressources en eau en Iran. En conséquence, la superficie irriguée et la productivité ont nettement augmentées. En tant que politique nationale, le Ministère de l'Agriculture Jihad a mis en place l'association coopérative de production dans certaines zones afin d'augmenter l'efficacité d'irrigation, d'encourager la rénovation des terres, de mécaniser l'agriculture et de moderniser l'infrastructure.*

*Dans cette recherche, l'évaluation des performances des activités de rénovation et de modernisation sont étudiés dans l'association coopérative de production de Kachurestagh. Une comparaison entre les conditions avant et après la construction du réseau (situation actuelle) sera également étudiée dans cette recherche afin d'évaluer différents aspects du fonctionnement des associations telles que la main d'œuvre, l'exploitation et l'entretien de systèmes et de leur évolution sociale, le statut des ressources et des installations, les activités de production, l'agriculture économique, les services de soutien et de gestion de l'agriculture.*

*L'association coopérative de production Kachurestagh, située dans le village Rigestan, dans la province d'Ispahan, a été créée en 2000. Le réseau d'irrigation et de drainage de cette association ont été étudiés en 2002 par le Ministère de l'Agriculture Jihad d'Ispahan. Les principaux points de cette étude étaient l'analyse des structures socio-économiques, l'eau et les systèmes d'exploitation du sol dans les secteurs agricoles et non-agricoles.*

*Dans la zone d'étude, les pesticides chimiques ont été utilisés en quantité copieuse, sans aucun contrôle, qui est nocif pour l'environnement. Mais après la rénovation et la modernisation, l'utilisation de pesticides est considérablement contrôlée. Les principales ressources en eau dans cette zone sont les puits, qui ont été utilisés pour l'irrigation avant la construction du réseau de manière non-scientifique, menant au déclin de la nappe phréatique. Mais après l'exécution du plan de rénovation et de modernisation, cette tendance a été gérée.*

*L'efficacité de l'irrigation a montré une tendance modérée à la hausse de 36 à 42 pour cent grâce aux travaux de rénovation et de modernisation. La surface cultivée a augmenté de 630 à 834 ha au cours de ces années. Le ratio avantage-coût est environ 1,04 qui est économiquement valable.*

**Mots clés:** Evaluation, environnement, réseau d'irrigation, modernisation, coopérative de production, rénovation.

# 1. INTRODUCTION

## 1.1 The establishment history of cooperative association in Iran

Cooperative associations are one of the operation systems in Iran’s agriculture which are established after territorial reformation laws in 1962.

The main goals of Cooperative association’s foundation are:

- Maximum use of water and soil resources by Irrigation networks construction and land grading.
- Construction of roads between villages and introduce the principles of cultivation to members.
- Reclamation of arid regions under these associations.
- Ensuring increase in production, farmer’s income and economic growth along with farmers’ ownership.
- Soil Reclamation in arid regions belonging to these associations.

In this research, the performance assessment of Kachurestagh Association (Fig. 1) where land equipping plans were implemented was done,. Kachurestagh association regions fall in Ardestan watershed, 10 km from northeast of Ardestan city. The productive area of these regions is around 970 ha. This association was established in 2000 with initial investment of Rials 80 million by 152 members.

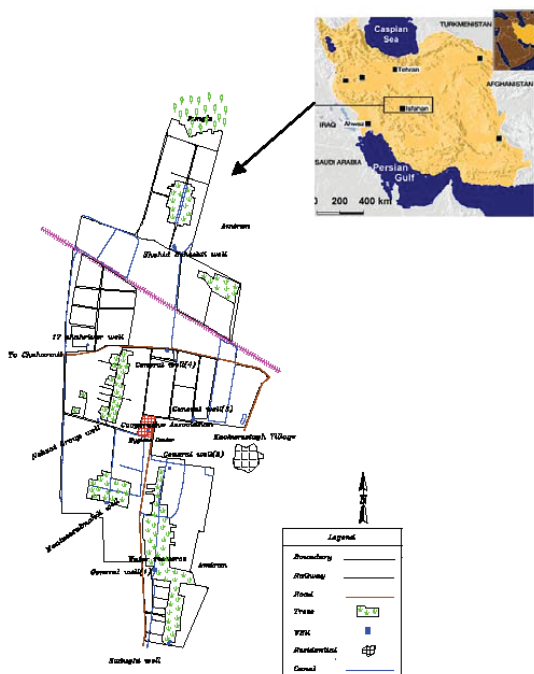


Fig. 1: Location of Kachurestagh association

## 1.2 Project technical characteristics

The main and secondary Irrigation network characteristics of Kachurestagh association are presented in Tables 1, 2 and 3.

Table1: Main Irrigation network characteristics of Kachurestagh association

Main network component	quantity
Gross Area	960 ha
Net area	834 ha
Main canals length	20 km
Canals discharge	50 to 80 Lit/s
Total supplied volume	12181428 cm

Table 2: Secondary Irrigation network characteristics of Kachurestagh association

Secondary network component	quantity	
Net area	834 ha	
Secondary canal length	20.5 km concrete	
Canals discharge	25 to 30 Lit/s	
Road length	25 km	
Drain's length	20.5 km	
Graded area	794 ha	
State	2467 million Rial	
Farmers	90 million Rial	
Secondary network component	quantity	
Net area	834 ha	
Secondary canal length	20.5 km concrete	
Canals discharge	25 to 30 Lit/s	
Road length	25 km	
Drain's length	20.5 km	
Graded area	794 ha	
Project Executive Cost	State	2467 million Rial
	Farmers	90 million Rial

Table 3: Comparison between detailed efficiency values

Time of efficiency	Type of efficiency (percent)			
	Transmission	Distribution	Application	Total
Predicted	95	90	55	47
At present	90	85	55	42

## 2. EVOLUTIONS DUE TO LAND EQUIPING PLANS

Land equipping in the studied association caused evolutions such as Irrigation canals construction, land grading and reclamation which had main role in water and soil operation trend and agro production increase. The plan construction impacts are:

### 2.1 Irrigation efficiency

Before the land equipping plan, the irrigation efficiency was 36%, which was projected to increase to 47% after the plan implementation. On the basis of field studies, the transmission efficiency was determined 90%, which is slightly lower than the predicted efficiency due to damage to the canals (Fig. 2). The distribution efficiency is about 85%, which is also slightly lower than the anticipated value of 90%, due to incomplete structural interventions. The water application efficiency in the field is estimated around 55%. As a result, the total water efficiency is 42%, which again is lower than the projected efficiency of 47%. As can be seen in Fig. 3, the measured efficiency after land equipping is 42 percent which could not reach the predicted one as a result of some obstacles mentioned in this paper.

In the consequence of land equipping plan accomplishment in the studied association, the water efficiency surge about 6 percent which causes 136 hectares increase in cultivated area.



Fig. 2. Damage to lined irrigation channels.

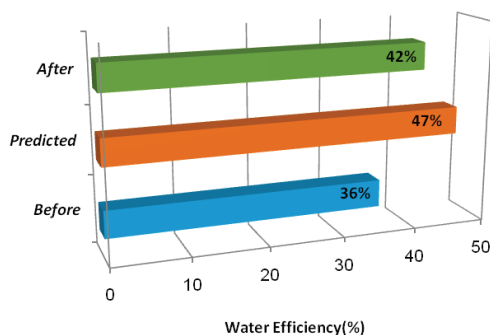


Fig. 3. Comparison between water efficiency values

## 2.2 Crop pattern change

Due to the implementing the land equipping plan, besides the construction of Irrigation network and land grading, soil reclamation was done via adding clay soil and fertilizer, therefore restrictions in garden expanding were largely removed.

Due to the above actions, crop pattern in gardening production rose from 17% to 24.5% and general cultivated area declined from 83% to 75.5% during these years (Fig. 4). Growth in garden crop area increased farmer’s income because of more valued production and income from garden crops. This expansion trend would be continued for olive and pomegranate cultivation. Wheat and pomegranate cultivation in the association land are shown in Fig. 5.

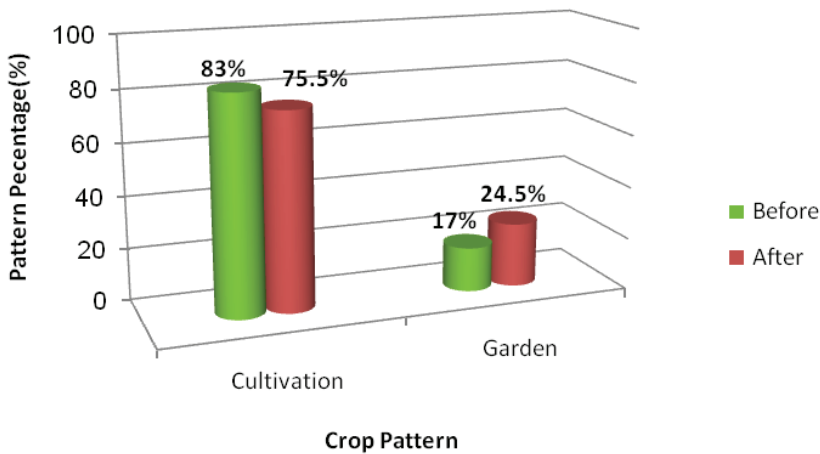


Fig. 4. Crop pattern before and after land equipping



Fig. 5. Wheat and pomegranate cultivation in association regions

## 2.3 Cultivated area growth

Water efficiency increase (after land equipping plan) caused substantial growth in cultivated area from 698 ha to 834 ha. Of this, 630 ha are allocated to normal cultivation and 204



ha to garden crop production. As can be seen below, cultivated area of each crop and gardening area pattern change are presented in Figures 6 and 7, respectively, before and after equipping plan.

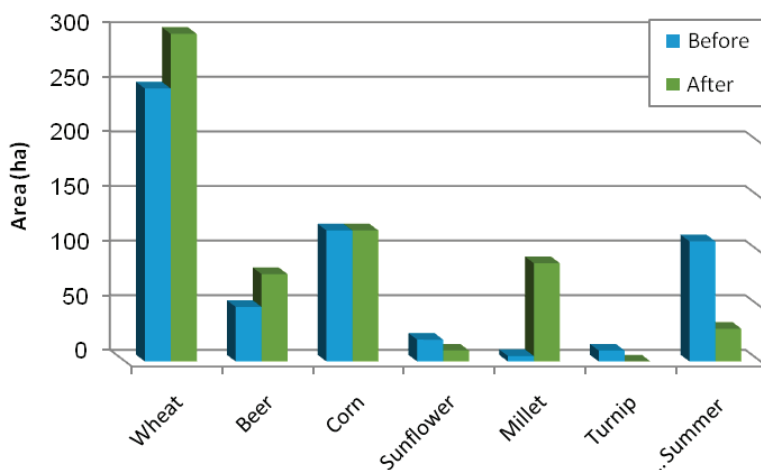


Fig. 6. Crop pattern change before and after equipping plan

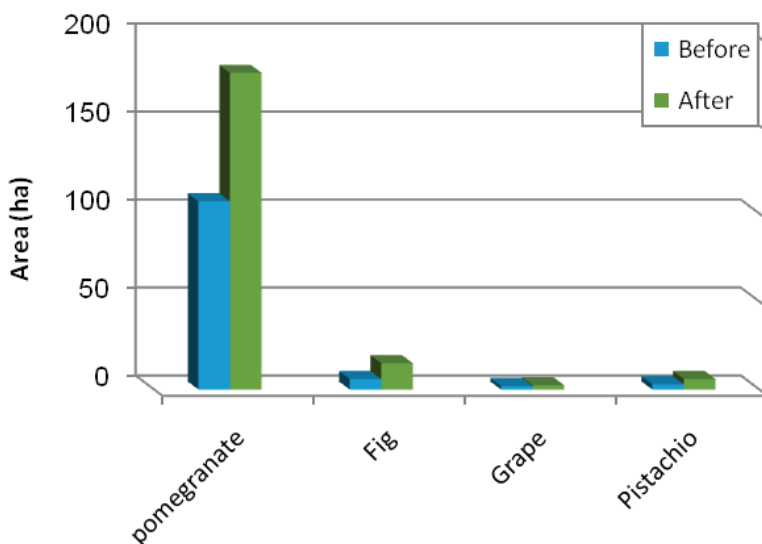


Fig. 7. Gardening pattern change before and after equipping plan

## 2.4 Production income growth

Crop production incomes in Kachurestagh association before and after land equipping are shown in the Tables 4 and 5 on the basis of performance per hectare and base year values. The maximum income growth is in pomegranate and millet. Field studies show that land prices are substantially increased after plan implementation.

Table 4. Crop production revenue before and after equipping plan

Crop	Cultivated area (ha)		Performance (Kg/ha)		Gross revenue (Million rial)	
	Before	After	Before	After	Before	After
Wheat	250	300	4500	5000	523.63	698.16
Beer	50	80	3700	4000	44.42	76.83
Summer crop	110	30	20000	15000	614.2	125.63
Corn	120	120	5000	5500	101.38	111.51
Sunflower	20	10	2000	2000	120.88	60.44
Turnip	10	0	30000	0	14.27	0
Alfalfa	15	0	10000	0	5.78	0
Millet	5	90	3000	25000	5.02	383.46
Sum	580	630	-	-	815.4	1456.03

Table 5. Gardening production revenue before and after equipping plan

Crop	Cultivated area (ha)		Performance (Kg per hectare)		Gross revenue (Million rial)	
	Before	After	Before	After	Before	After
Pomegranate	107	180	20000	20000	396.71	667.37
Fig	6	15	15000	8500	19.02	26.94
Grape	2	2.5	10000	9000	7.4	8.32
pistachio	3	6	-	-	-	-
Olive	20	10	-	-	-	-
Sum	118	204	-	-	423.13	702.63

## 2.5 Employee population changes in agriculture department

From the studies, it is observed that before land equipping, 66% of employee population worked in agriculture department and 34% in industries. These values are increased to 20 percent after land equipping. It can be seen that, one of the most important reasons for agriculture employee population growth is cultivation area expansion and crop pattern change after implementing land equipping plans.

## 2.6 Operator's viewpoints about land equipping

For recognition of existed facilities and limitations to preserve land consolidating, farmer's viewpoints about advantages and disadvantages are important. Some of these opinions are presented below:



Land consolidating advantages:

- Crop production increase
- Water lost prevention and water efficiency growth
- Operator's problems decrease
- agricultural mechanization
- production expenses decline
- optimum time utilization

Land consolidating disadvantages:

- dissension between groups beneficiary members
- farmer's different opinions and solving problems
- varied cultivation demand and its impossibility

With due attention to facilities and limitations of land consolidating, supporting advantages and decreasing its disadvantages are important ways to improve this condition; therefore, having powerful management in cooperative association, training workshops, idea exchange and social quarrel deduction could support advantages and optimum utilization of water and soil resources.

## 2.7 Farmers information about participatory methods

Dazzling expenses of Irrigation and drainage networks maintenance was the most important motive for farmers participatory in networks management. The other ingredients such as unsuitable operation, inattention to farmer's satisfaction and canals destruction trend caused that government decided to transform networks management to the farmers.

For water user association establishment, some legal, juridical and executive supports are needed. These are included financial management, legal independence, necessary potentials such as technical training, management proficiency, physical installation and certain water resources.

## 3. PROBLEMS IN KACHURESTAGH COOPERATIVE ASSOCIATION

On the basis of field studies for performance assessment of Kachurestagh association, some problems and bottlenecks were observed in achieving plan goals.

### 3.1 Existed problems in Irrigation network

- canal's concrete lining damage
- canals without gates in division boxes
- not grading 40 hectares of farms

- Maps of Irrigation network were not available for precise comparison between before and after land equipping

### 3.2 Management problems

- unsuitable management in association
- machinery sale such as combines
- not holding training workshops for farmers
- not paying suitable salary to association's manager, accountant and storekeeper
- self-support policy in association without sufficient prior preparation
- political and social problems in kachurastagh village

## 4. CONCLUSIONS AND RECOMMENDATIONS

Comprehensive studies in Land equipping plans which are included secondary Irrigation networks construction and land grading are necessary due to social problems. Whereas, occupied farms via canal, drain and road band in secondary networks are not bought from farmers. Construction activity there is not smooth for the executors due to resistance from the farmers. So, more attention to ownership and cadastre boundaries during project designing is needed to help making a better plan and undertake construction activities according to the plan.

With a view to giving solutions for association statues improvement and problem's removal, some procedures are recommended as below:

### 4.1 Suggested solutions for plans promotion

#### A) Training

After land equipping, farmers realized that Irrigation network and farm grading is important but difficult for them. Thus farmer's training is essential for smooth operation and maintenance of the network. Therefore, training workshops should be held by Jihad-Agriculture Ministry for operators to update their information especially on self-support; whereas, when the farmers recognize network construction prices and problems, they could help to renovate destructed canals, gates, bridges, division boxes and land grading for better operation.

#### B) Specialized services utilization

Based on the assessment results, it is recommended that the third phase of soil and water plans should be done by the same consultant who studied the second phase.

## 4.2 Suggested solutions for cooperative association promotion

### A) Step by step association self-supporting

The government policy in starting association operation was to employ experienced personnel for working as manager, accountant, storekeepers and the other positions to control association; on the other hand, after self-supporting policy, the government decided to shift management to farmers which was not smooth. In this case, it is recommended that management should be changed gradually until the members can find their real situation and work independently to avoid problems.

### B) Prevention of political conflict in management system

As can be seen in this association, for restricting political conflict, elected manager should not belong to any political party in the village.

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