

TRADITIONAL IRRIGATION DISCIPLINES AND ITS ROLE IN IMPROVING IRRIGATION MANAGEMENT: A CASE STUDY IN IRAN

SCHEMAS D'IRRIGATION TRADITIONNELLE ET LEUR ROLE DANS L'AMELIORATION DE LA GESTION D'IRRIGATION : ETUDE DE CAS EN IRAN

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ABSTRACT

Indigenous irrigation systems have been a central feature of agriculture in Iran for over a millennium. Rural societies had inculcated a sense of discipline in the management and sharing of water for irrigation. A case study was conducted in Tilakan irrigation network in Fars province, Iran through comprehensive survey to identify the features of traditional irrigation systems and their management. According to the survey result, the farmers believed that water delivery from modernized irrigation networks was a challenge to them because of faulty design of hydraulic structures in irrigation systems. It reduces water users' contribution in water operation and management. On the contrary, in regions in which farmers use traditional irrigation systems, there is no difficulty in irrigating the farms. It is pointed out that promoting water management is possible through farmers' participation in operation and distribution of irrigation water, as happened in the past. It is demonstrated that adopting a new technology and upgrading the infrastructure alone are incapable of improving irrigation management. It is necessary that the farmers participate design, construction, and water management to enhance sustainability of irrigation systems, improve water management and agricultural productivity, and to cope up with the constraints in government budgets. It is recommended that new irrigation networks be designed according to the existing traditional irrigation disciplines and desires of the majority of water users.

Key words: *Traditional irrigation, Farmers' involvement, Tilakan irrigation network, Kor River, Inequity.*

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RESUME ET CONCLUSIONS

Du fait que l'eau constitue un élément vital pour l'agriculture, la gestion de l'irrigation a fait l'objet de nombreux travaux. Plusieurs d'entre eux consistent à identifier les techniques traditionnelles d'irrigation qui démontrent un savoir faire dans la gestion durable des ressources en eau (Maheshwar, 2007). Certains systèmes vernaculaires d'irrigation font parti des éléments centraux de l'agriculture en Iran depuis plus d'un millénaire. Les sociétés rurales possèdent une gestion particulière concernant le partage des ressources en eau, gestion qui s'appuie sur les spécificités des systèmes d'irrigation présents sur les territoires. Une étude de cas a été conduite en Iran sur le réseau d'irrigation de Tilakan dans la province de Fars. La totalité des règlements régissant la gestion des ressources hydriques s'appuient sur les systèmes traditionnels d'irrigation de la zone étudiée.

L'article présente l'étude des techniques traditionnelles de gestion de l'eau comme étant un élément clé dans la conception et la gestion des réseaux d'irrigation. Plusieurs schémas d'irrigation sont présents à Tikalan, certains modernes et d'autres plus traditionnels. L'article indique que l'approvisionnement d'eau à partir du réseau d'irrigation récent est problématique pour les agriculteurs en raison de défauts de conception au niveau des ouvrages hydrauliques dans les systèmes d'irrigation. Les dysfonctionnements des canaux récents provoquent une réaction négative de la part des agriculteurs, ces derniers se montrant réticents vis-à-vis de la modernisation d'autres parties du système d'irrigation. La contribution des utilisateurs au bon fonctionnement et à la bonne gestion des systèmes d'irrigation s'en trouve diminuée. Afin d'améliorer la gestion de l'eau sur ce territoire, les systèmes d'irrigation récents, pour la plupart mal conçus, devrait être modifiée le plus rapidement possible. A l'inverse, dans les régions où les agriculteurs utilisent des systèmes d'irrigation traditionnels, aucune difficulté d'irrigation n'a été constatée dans les fermes. Dans ces régions, les agriculteurs coopèrent pour recueillir les redevances et les paiements à verser à la Régie Régionale de l'Eau de la province de Fars, pour sélectionner les modes de cultures agricoles les plus adaptés et pour entretenir le système d'irrigation. L'article souligne que la promotion d'une bonne gestion de l'eau est possible grâce à la participation des agriculteurs dans l'exploitation et la distribution de l'eau provenant des systèmes d'irrigation, comme cela était le cas par le passé. La participation des agriculteurs dans la gestion de l'eau facilite également le transfert de la gestion du système d'irrigation des organismes gouvernementaux vers les associations d'usagers de l'eau.

Cette étude fait valoir que les systèmes d'irrigation récents ne sont pas en mesure de satisfaire toute la demande en eau des diverses zones considérées. Au sein de la zone d'étude, les réseaux d'irrigation récents offrent une distribution d'eau inégale et aléatoire. Des plannings d'utilisation et de maintenance mal conçus, un manque de collaboration entre les usagers de l'eau et les gestionnaires du système ainsi que des défauts de conception au niveau des structures d'irrigation entraînent une gestion médiocre de l'irrigation. Enfin, l'article précise que la participation des agriculteurs dans la conception, la construction et gestion des systèmes d'irrigation est nécessaire pour augmenter la durabilité de ces systèmes, améliorer la gestion de l'eau et la productivité agricole, et pour faire face aux contraintes budgétaires. L'étude de cas indique que l'adoption de nouvelles technologies et la modernisation des infrastructures existantes sont à elles seules incapables d'améliorer la gestion de l'irrigation. L'article recommande que les réseaux d'irrigation soient conçus

selon des schémas d'irrigation traditionnels, schémas plébiscités par la majorité des usagers de l'eau. Cette étude démontre que la participation des usagers de l'eau est nécessaire à l'étape de conception initiale des structures d'irrigation.

Mots clés: *Irrigation traditionnelle, participation des agriculteurs, réseau d'irrigation Tilakan, rivière Kor, iniquité.*

(Traduction française telle que fournie par les auteurs)

1. INTRODUCTION

The utilization of land and water, which are the most important physical elements of an irrigation project, must be improved to achieve sustainable productions from irrigated agriculture. As the preservation of water resources is becoming a major environmental priority, improving irrigation management is essential. Since traditional irrigation disciplines are the outcomes of the deep knowledge of local conditions in response to changing socio-economic, political and ecological factors (Hans et al., 1996), recognition of these indigenous systems is necessary to ameliorate the current maladies in irrigation management. Traditional irrigation is a dynamic process in which farmers are able to utilize their knowledge and experiences in improving irrigation system performance (Adams et al, 1994). However, these traditional disciplines become non-functional when the irrigation systems are influenced by the operational rules defined by the designer when the irrigation system is modernized. In the irrigation sector, designers have rarely operated the systems they have designed and have not encountered the operational problems at the field level. Therefore, they do not pay adequate attention to all key factors that determine appropriate irrigation system design. As a result, most of the design standards have failed to meet the objective of delivering water to users. A high performance design is the one that meets all needs and purposes of irrigation systems. The sole aim of modern irrigation is to give service to farmers. This service should be as convenient and efficient as possible. Therefore, designers must have a comprehensive understanding of management and operational skills apart from an up-to-date knowledge of the hydraulic concepts and technologies. According to the author's experience, modernizing irrigation networks has had adverse effects on the performance of irrigation systems since designers do not follow the design and operating rules in the existing traditional irrigation systems which had been based on the real needs of farmers (Haseb, 2001 and ArvinTadbir, 2008). Modernization is more effective if the initial idea comes from the water users. Designers should then optimally combine these ideas, knowledge of hydraulics concepts, and the behavior of the system under operation to achieve the desired standard of design and operation of the irrigation system.

A key factor to attain high performance in irrigation projects is involving farmers in operation, maintenance, monitoring, and evaluation of the systems (Vuren et al., 2004). History reveals that our ancestors had a unique *modus operandi* for harnessing and managing water resources in Asia (Bhavsar and Bhalge, 2007). Studies of such systems as Ganats in Middle East demonstrated that farmers were able to implement a complex engineering and sophisticated water distribution management (Ruth, 1997). Therefore, the basic standards and rules for land irrigation came from traditional irrigation wisdom. That is why; designers should take farmers' ideas into account to design new irrigation projects to prepare a suitable plan. The water users

then will be motivated to participate in irrigation management, and the outcomes will be care of the infrastructure by the farmers, reducing water theft, enabling a quick response to system breakdown, reducing maintenance costs, and promoting the operation and maintenance of the system. This study examines the role of the traditional irrigation disciplines in water management in Tilakan region, an irrigation system in Iran, and explores how faulty design of modernized irrigation networks affects the performance of the system.

2. SITE DESCRIPTION AND METHODOLOGY

The study was conducted in the southern part of Iran, Tilakan, in Fars province (29° 36' N, 53° 05' E). The average yearly precipitation is 297 mm occurring from December to April. The mean annual temperature is 17.6 °C. This area is classified as arid and semi arid. The only source of water is the Kor River. The irrigation system (Fig. 1) includes a diversion dam, two modernized canals located at right and left bank of the Kor River with the lengths of 10411 and 11027 m, respectively, and 6 traditional canals dug by the farmers (Chaussee Construction Company, 2010). The cultivated areas on the right and left sides of the river are 4300 ha and 4860 ha, respectively, and devoted to rice cultivation if sufficient water is available. Otherwise, wheat is cultivated in all fields. The performance of the modernized irrigation canals and the management of the traditional irrigated parts were assessed by interviews with farmers, village heads, and water operators during July - August 2010 with multiple visits to the purposed region. In the survey, operating disciplines, standards and rules for irrigation were evaluated. The irrigation canals were surveyed using a GPS device and faulty designs, which have adversely affected the performance of the modernized canals, were recognized. This information is invaluable for modernizing the other parts of irrigation system.

3. RESULTS AND DISCUSSION

Local visits to Tilakan region revealed that villagers have been managing water for many years based on the wisdom inherited from their ancestors. However, the exploitation and distribution of the water resources have been managed by the government since land reforms of 1960s. In the surveyed area, there are two types of water distribution management: the water management in the modernized irrigated zone and in the traditional irrigated zone.

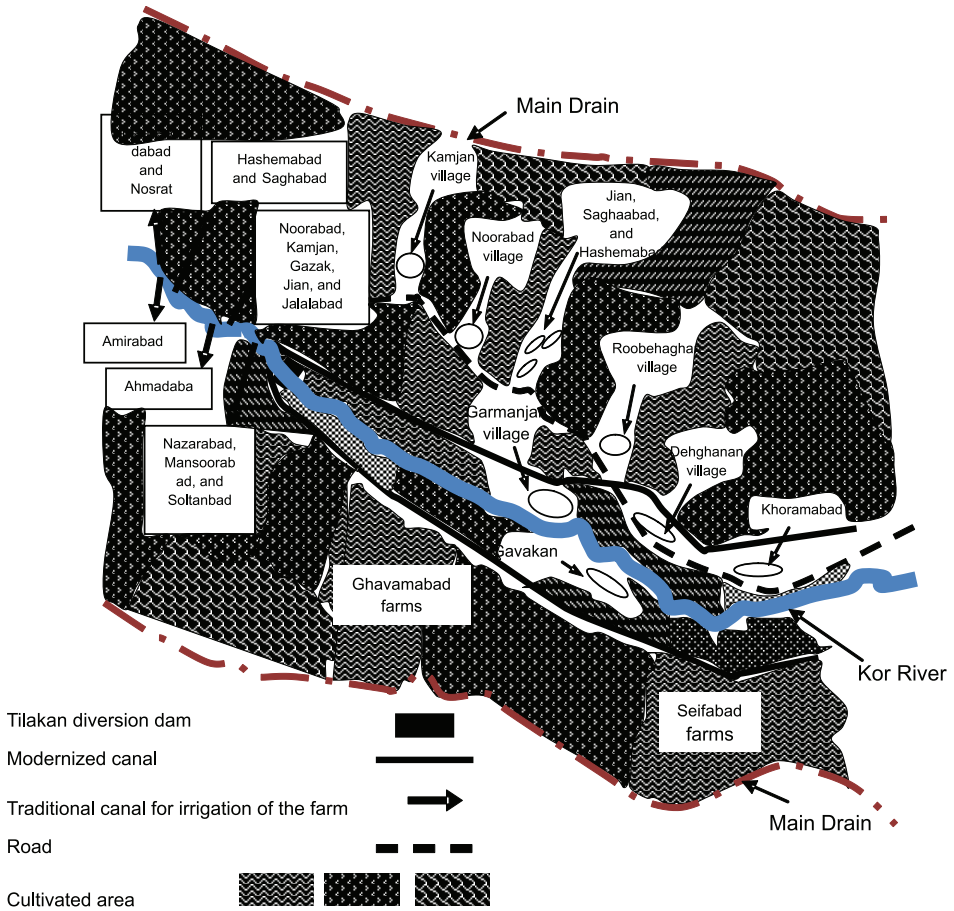


Fig. 1. Tilakan irrigation network (Réseau d'irrigation de Tilakan)

3.1 Modernized irrigated regions

In this part, there are two main modernized irrigation canals at the right and left banks of the Kor River that deliver water to users by constructed turnouts along the canals. Water is distributed among the farmers by the staff of Fars Regional Water Authority. These canals are used for irrigating the farms of Garmanjan, Roobehagha, Dehghanan, Khoramabad, Ghavamabad, Ghavakan, and Seifabad villages. The faulty design in the layout of turnouts and check structures causes

poor performance of the modernized irrigation systems. Since check structures are not at right locations along the canals, farmers have to use bags filled by sand to make the level of water rise for water flow into the turnouts (Fig. 2). As there are no protective structures at the end of the turnouts, they are susceptible to be destroyed (Fig. 3). In this zone, the old design standards of the Bureau of Reclamation have been used for design of irrigation networks without regard to the needs of the farmers. These mistakes in the design of hydraulic

structures in irrigation systems have resulted inequity in water distribution between top-enders and tail-enders of the irrigation canals.



Fig. 2. Dand bags in canal (Sacs de sable dans le canal d'irrigation)



Fig. 3. Damaged turnout (Destruction de la fin de la turnout.)

Thus, the end of canals path has run dry since they have been constructed and water has not been delivered to the final users at downstream of these two canals. This malfunctioning of the modernized canals gives a negative impression among the farmers leading to a resistance against modernizing the other parts of the existing irrigation scheme. To improve water management in this region, the irrigation systems built on wrong design should be modified as fast as possible. It will make the farmers' view positive towards the performance of the modernized canals. Moreover, re-engineering the modernized irrigation canals will motivate the farmers to participate in irrigation management leading to more efficient operation of the system and equity in water allocation and distribution among farmers.

3.2 Traditional irrigated region

In this part, there are 6 traditional irrigation canals at the right and left banks of the Kor River. These canals dug by farmers carry water to the crop lands of Maghsoodabad, Hashemabad, Saghaabad, Gzak, Jian, Jalalabad, Amirabad, Ahmadabad, Nazarabad, Mansoorabad, and Soltanabad villages. Each village has two or three representatives who are elected by the farmers. These delegates are in charge of collecting fees from the users, delivering water, and distributing water among the farmers. Each traditional canal is divided into distinct paths by water distributors, built by the farmers according to the existing users and the amount of farmlands along the canal. A type of indigenous irrigation scheme is indicated in Figure 4. In this pattern, the traditional canal is divided into several paths in accordance with the numbers of existing farmers. As can be seen from Fig. 4, there are 18 brooks for 42 existing farmers. On this model basis, all users are capable of irrigating their farms simultaneously

with a full justice. Therefore, there are regular irrigation disciplines with no difficulties in water distribution and management in the indigenous irrigated area. In this region, farmers cooperate to collect water charges and payments to Fars Regional Water Authority, to select patterns of agricultural crops for the farms, and to operate and maintain the irrigation system. To modernize the traditional irrigation scheme, involvement of farmers in the initial planning and design and determination of operational rules are necessary. This will motivate farmers to cooperate in construction, management, and maintenance of the modernized irrigation projects with a higher sense of responsibility. Farmers' participation in water management also makes the transfer of irrigation system management from government agencies to water user associations easy. It is obvious that participatory irrigation management results in increasing the efficiency of water consumption, improving the performance of irrigation systems, and reducing the financial burden on the government (Taleshi, 2009).

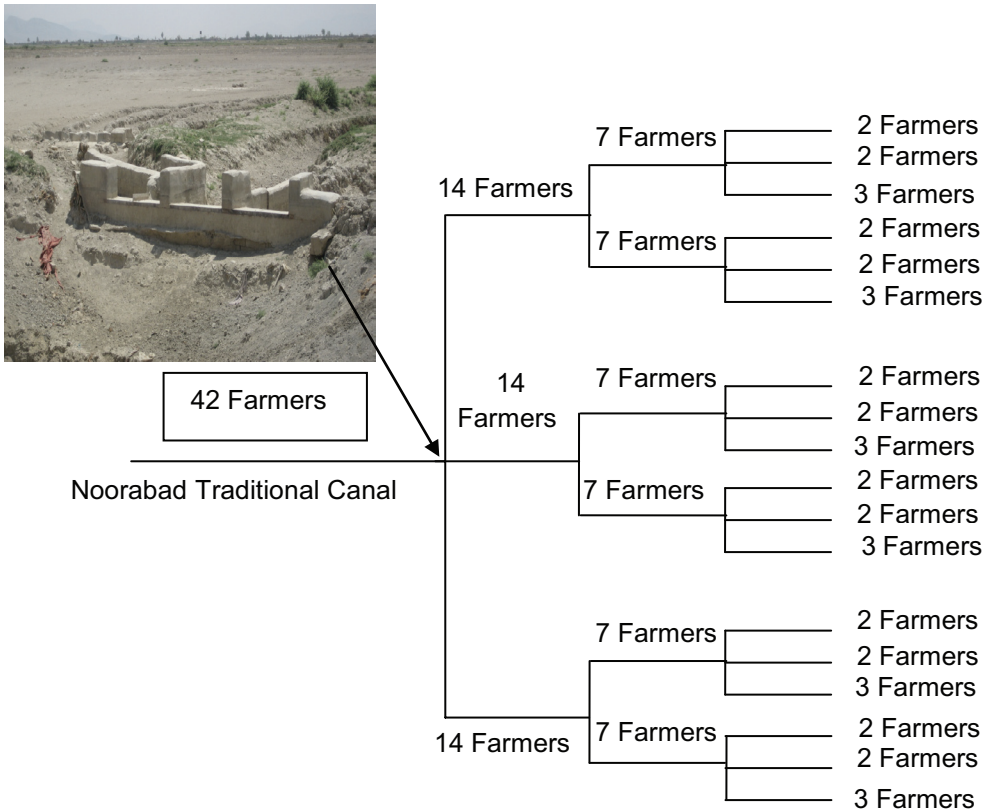


Figure 4. A type of traditional irrigation scheme (Un type de schéma traditionnel d'irrigation)

4. CONCLUSIONS

Two types of water distribution systems in Tilakan irrigation network were presented and compared. In the modernized irrigation regions, faulty design and inappropriate layout for structures such as turnouts and checks result in inadequate water level in the irrigation

canals and a deficient irrigation. These problems have induced farmers to have a negative view causing a severe resistance against modernizing the irrigation system in other parts of Tilakan. On the contrary, the users collaborate on water sharing and maintenance of the irrigation scheme in the region irrigated traditionally without any difficulty. It is concluded that modernized irrigation canals must be modified according to the farmers needs so that the farmers' pessimism be diminished. To modernize and design of traditional irrigation systems, the farmers' ideas and existing indigenous irrigation disciplines should be taken into consideration. It gives the farmers the incentive to participate in constructing and finally maintaining and managing the irrigation network leading to improving the financial and physical sustainability of the irrigation system and to promote the operation and maintenance of the irrigation project. This study shows that modernizing the irrigation scheme alone will not lead to improving water distribution and management. Participation of water users is required in initial design and layout of irrigation structures.

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