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Economic Evaluation of the Farm Irrigation Systems in Mashugager and Telaband Villages on the Warsak Lift Canal in the North West Frontier Province of Pakistan

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Summary

All irrigation depends mainly on the distribution of irrigated water. This sometimes creates conflicts among farmers. If the system of distribution is not well organised then the irrigated water designed for production can either be totally lost or significantly reduced. In view of the importance of water management in our own agricultural process, a case study of the Mashugager and Telaband villages on the Warsak Lift Canal was conducted for this project. The importance of the study demonstrates several considerations. Firstly, the study will show the economic and social characteristics of the irrigators by the type of tenure in the research area. Secondly, it will show how the Warsak Lift Canal system has behaved over the 1966 to 1991 period. Finally, it will offer some suggestions on the basis of the reactions of the farmers of the area for improving the existing situation of the villages.

1. Introduction

Every irrigation depends mainly on the distribution of the irrigation water. It sometimes creates conflict among farmers. Unless some well organised system of distribution of irrigation water is designed, production is either totally lost or reduced very much. For most of the irrigation areas, water distribution is traditionally determined depending on area and crops irrigated. Yet water distribution is often inadequate and unequal, affecting the Agricultural productivity adversely.

Several factors may be responsible for this.

(1) Inadequate water supply
(2) Defective canal and conveyance system.
(3) Mismanagement and improper operation of the irrigation system.
(4) Unauthorised and undue use of water by the farmers.

A rigid cropping system has been developed due to a fixed and traditional distribution system based on the irrigation area rather than the actual water used. It leaves no provision for the alternative cropping patterns. Conveying irrigation water in the right quantity and at the right time to the various parts of the conveyance system is very important. It only depends upon an adequate conveyance system but also requires management and operational kills of the farmers and the irrigation service. Factors determining are several.

a. One of the main canals supplies water to the farm irrigation through the irrigation service in case of the large irrigation schemes.

b. Physical conditions like canal layouts and hydraulic conditions are crucial in the conveyance of water.

Regulating and measuring devices such as well designed and simple operation structures ensure the adequate distribution of water. Tim-

ing of irrigation is very important in order to get the best crop. Water must be provided at the right time when the crop requires it. Irrigation methods not only include the right timing but also the correct amount of water supply. It also requires the skill and the discipline of the farmers in handling waterline managing and organising the distribution of water which also includes pricing. Different studies indicate a vast amount of water wastage from the irrigation system particularly beyond the canal outlet. The cause has been the badly constructed and poorly maintained and in some cases centuries old community watercourses. A significant amount of water losses (about 40%) occurs in badly constructed and poorly maintained community water watercourses. These losses are due to seepgae, spillage and other forms of leakage from the watercourses. The main objective of this study was to explore and examine the farm irrigation system at the village level. The major objectives of this study are.

i. To describe some of the socio-economic characteristics of irrigators by type of tenure.

ii. To discuss briefly the Warsak Lift Canal System and its effect on the irrigated agriculture of the selected villages.

The study was conducted in September 1989 in the North West Frontier Province in two villages i.e. Mashugager and Telaband in Pakistan by collecting the primary data through the farm survey by a group of researchers including the chairman of the Department of Agricultural Economics NWFP Agricultural Uiniversity Peshawar Pakistan, Economic investigators including the author of this paper.

2. Methodology

Two case study villages were selected for detailed study. The first village was selected at the middle and the second village at the tail end of the Warsak Lift Canal. In each village one watercourse was selected for detailed study. Moreover, in each case study village, thrity farmers were selected randomly along the selected watercourse. They were selected in such a way that 5 farm owners and 5 farm tenants at the head, 5 farm owners and 5 farm tenants at the middle and 5 farm owners and 5 farm tenants at the tail of each village. Two types of data was used in this study i.e. secondary data and the primary data. The primary data was collected through face to face interviews with the farmers whereas the secondary data was collected through the canal patwarie, officials of the Warsak Lift Canal, vilage elders etc. Because of the immense water wastage from the irrigation system, the Government of Paksitan launched "On Farm Water Management Pilot Project (OFWM)" during the year 1976/77 in selected irrigation areas with the following objectives.

(1) Increase the overall irrigation efficiency of the watercourse command system through improved on farm water management practices including the improvement of the watercourses and precision land levelling.

(2) Increase agricultural production by the effective use of irrigation water saved through improved irrigation agronomy and management practices in the watercourse command area.

(3) Improve water management techniques and institutional arrangements including the organisation of formal and effective Water Users Associations (WUAs) and the training of the personnel.

(4) Serve as a transitional model for the future OFWM project that could be effectively replicated on all watercourses in Pakistan. The canal system in our country was designed in the second half of the 19th century during the British regime with an objective of ensuring extensive irrigation for bringing more area under irrigation and to settle more people. This system provided a water allowance of about one cusec for 75

acres in the Imperial Valley System in California.

In view of improtance of water management for our Agriculture, a case study of the Mashugager and Telaband was conducted on the management of the irrigation systems on the Warsak Lift Canal in this Project. The importance of the study rests on several; considerations. Firstly, the study will show the economic and social characteristics of the irrigators by the type of tenure in the research area. Secondly, it will show how the Warsak Lift Canal system has behaved over the 1966-91 period. Finally, it will offer some suggestions on the basis of the reactions of the area for improving the existing situation in the villages.

3. Warsak Lift Canal

The Warsak Lift Canal located in the North West Frontier Province of Pakistan is designed to serve a culturable command area of 45,354 acreas through a network of canal having a total length of about 46 miles in tribal area and districts of Peshawar and Nowshera. The performance of the Warsak Lift Canal remained satisfactory in its beginning but with the passage of time its performance was affected and it also faced multifarious problems due to which the canal could not maintain its earlier position. It was, however, in 1978-79 when the canal faced severe shortage of water. It remained dry for a long time and the performance of the pumps was effected by the fluctuations in the power system. The pumps were not maintained properly with the result that they could not discharge 120 cusecs of water. This attracted the attention of the Irrigation Department and a number of studies were conducted to solve the problems of the lift canal. The following problems were responsible for the shortage of the water in the canal.

(1) Wear and tear of the pumps

In the beginning the performance of the pumps remained satisfactory because the silt was trapped by the Dam. But due to lack of the attention towards the wear and tear pumps, the reservoir got fully silted up and silt ladden water caused erosion and abrasion of the pumps volutes, impellers, rigs and sealing surfaces. This resulted in a decrease of the pumping capacity.

(2) Seepage losses

The canal passes through the torent zone, the soil is shingle, gravel formations and permeable due to which the seepage losses are the highest.

(3) Unauthorised and tempered outlets in the tribal area

The Warsak Lift Canal passes through the tribal area of Khyber Agency. In the tribal area the people have installed unauthorised outlets and have also tempered a number of sanctioned outlets and pumps.

(4) Tempered outlets in the settled area

In the setteld area of Khalil and Mohammand, 13 outlets have been tempered by force withdrawing about 11.05 cusecs over and above the authorised share.

The Irrigation Department conducted various studies and suggested the following measures towrads the solution of these problems.

i. Replacement of the Pumps

In 1983 the Provincial Government prepared a scheme for the replacement of old and disorder pumps. But due to financial constraint, the new pumps could not be installed. Later, the USAID committed to finace the replacement of these pumps under the Command Watrer Management Project. So far the USAID has replaced two of the old pumps and three more will be made availabele in future. M.Ashraf concluded that the poor management of irrigation supplies between Mogha and fares was one of the weakest links in the entire conveyance system.[1]

ii. Seepage Losses

To improve the reliability of the canal and to reduce the water losses, the canal has been lined for 20 miles under the Command Water Management Project. Further works of improvement are also under consideration. Hardin stated that the lack of the community responsibility for the upkeep of the entire watercourse system with the reluctance of the irrigation department to asert its full legal authority at the watercourse level resulted into the tragedy of the commons.[2]

iii. Unauthorised and Tempered outlets and domestic pumps in the Khyber Agency

With the help of the Political leaders, the Irrigation Department succeeded to close the unauthorised and tempered outlets and removed the illegal pumps during January, 1990. But in the settled area of Peshawar district this could not be done due to political reasons. The matter is under the active consideration of the Government and it is hoped that the unauthorised and the tempered outlets will be ractified in due course of time. Johnson et al showed that the problem of the low application efficiency could not be solved by the watercourse improvement alternatives.[3] The primary function of the Irriagtion Department is to deliver water at the outlet on a reliable and equitable basis.

iv. Scheme for the improvementand rehabilitation of the existing system of the Warsak Lift canal machinery

Some of the other problems such as the replacement of the old motors and the problems of the low voltage are also solved through this scheme to a greater extent. The inadequate water supply tends to encourage individual water users to enhance their supply in order to maximise their irrigated area. Farmers at the middle of the system made modifications to their watercourse at the expenses of the farmers at the tail of the system. The equitable distribution of water is a major objective of the irrigation system. But inequality of water distribtion is a common feature along the lift canal as the conveyance losses continously reduce the avalilable water supply down the water course. Bismas and Mandel submitted a report on a farm water management problems. The document reports the findings and conclusions of a field research project on farm water management problems of three irrigation schemes in Mymensing district of Bangladesh.[4]

The water supply could be increased by increasing the pumps discharge to the design level of 200 cusecs. This is already a part of the Irrigation System Rehabilitation Programme. Another means of increasing the water supply at the village level. Gilbert L.Corey and Wayne clyma discussed the strength and weakness of the irrigation system in detail and summarised the problem that appeared to be the largest contribution of the limiting agriculture production.[5]

4. Research Villages

The Warsak Lift Canal constitutes the Project area of a newly incepted Command Water Management Project. The whole area is located in Peshawar-Nowshera district and a part of the tribal area in the Khyber Agency. The Project area is bounded by the Pabbi-chart road in the west by the Warsak village. The northern boundary is formed by the Gravity Canal where the Warsak Lift Canal itself demarcates the southern boundary. It covers a gross area of 54, 600 acres out of which 16% falls in Nowshera tehsil, 1% in tribal area of Khyber agency whereas the remaining 83% falls in the Peshawar Tehsil. The culturable comand area is 46120 acres out of which about 80% area is under the outlets wheras the remaining 20% area is being irrigated through four minor off-taking from the main canal. The command area is served by the 60 kilometers of the main canal, four minors of 13.69 kilometers length through a total number of 151 water courses. The area is climatically suitable for a year round farming system. The soils are basically fertile and are fit to sutain a wide

variety crops for better growth. Inhabitants are having farm business as their main profession. In addition, breeding of livestock is also one of the important occupations in the area which contribute a considerable share of their income. In the Mashugager village, the household number was 500 with the population 2, 533 persons in 1966. After the construction of the Warsak Lift Canal, there has been increase in the household number upto 910 with the population of 5,228 persons in 1966. The people from other areas came and settled in the Maira Telaband after the construction of the Warsak Lift Canal. The population of the Maira Telaband went upto 1,831 persons with 170 households while that of Azakheil went upto 1,831person with 2,095 households in 1990. The current fallow was more in Telaband than in Mashugager because of the shortage of water in the Telaband village i.e. 347 acres in Telaband while 40.97 in the Mashugager. In both the villages there were two main classes of farmers landlords and tenants. The tenant class pay 50% for inputs and receive 50% in output while the revenue is paid by the landlords. The social structure of these villages is multi linkeage. Both the villages are inhabitated by the two tribes i.e. Afridis and Mohammads. In both the villages, all the issues are settled by some key individuals or dignatories of the village. The dignatories have some qualities and characteristics e.g they must be aged one, must belong to a big tribe and must be big landlords. The customary share between the landlord and the tenant is half of the final produce in both the villages. The cost of the inputs such seed, fertliser, plant protection measures and water charges are equally divided between the two parties. The persons who possess relatively big land holding and are in high age group belong to the majority tribe. Such persons are generally the leaders in both the villages. The leaders handle the cases of political, economic and social nature. Water issues lead to conflict to some extent. The Command Water Management Project combined the Warsak Lift Canal rehabilitation and remodelling activities with watercourse and the OFWM improvements, increased Agricultural Extension Services, participation and improvement of Agricultural credit resources and other non water inputs from the private sector as well as the responsible Government agencies. The implementation of the canal rehabilitation are the responsibility of the Provincial Irrigation Department and the OFWM is responsible for the watercourse improvements and the extension wing is responsible for the Agricultural education activities. Other agencies such as the Agricultural cooperative Department, Agricultural Development Bank, Agricultural Development Authority and the Commercial Banks are all participating in improving credit and other non-water inputs in the project area. Chisolm showed the socio-economic factors related to

5. Analysis

The collected data were then analysed and checked carefully to make sure that it was correct and complete in all respect. Each question was given a code number after checking. After codifying the data it was transferred to the master sheets by each group in each village. The descriptive type of question was analysed in a descriptive fashion on the basis of some categories as far as possible while for the statistical type of question chi-square tests were run on the computer to determine the level of association between variables at 5% level of significance.

The total area irrigated during the Kharif 1989 and Rabbi-1989-90 and the crops grown and area and amount assessed in Mashugager and Telaband are shown in Table 1.

Table 1

According to Table 2, the location of the farmers in both the villages collectively showed that the null hypothesis was rejected. It means

Table 1 Total area irrigated, Crops grown and Area and amount assessed Kharif 1989 and Rabi 1989-90
Unit :-(Acres, Rupees)

S.No	Items	Mashugager			Telaband		
		Kharif 1989	Rabi 1989-90	Total	Kharif 1989	Rabi 1989-90	Total
1	Tot area cultivated (Acres)	1882.92	2259.52	4142.44	657.62	544.45	1192
2	Current fallow	31.06	9.91	40.97	321.56	25.44	347
3	Net area cultivated	851.86	2249.61	4101.47	326.06	519.1	845.2
4	Gross amount assessed (Ruppees)	148357.22	125539	273896.2	29751.52	35345.2	65070
5	5% commission paid to Lambarder	7417.86	6276.95	13694.81	1487.59	1767.26	3255
6	Net amount assessed	140939.36	119262.05	260201.4	28263.94	33566.94	61842

Major Kharif Crops (1989) are sugar cane, maize, orchards, vegetables, pulses and fodder etc.
Major Rabi crops (1989-90) are wheat,barley, vegetables, oilseed, fodder and pulses.

that the timely availibility of water was associated with the position of the farmers on the watercourse. In other words, the farmers at the head had received sufficient amount of water as compared to those who were at the middle or at the tail of the watercourse in both the villages.

Table 2

According to Table 3, in the Kharif 1989, the null hypothesis was accepted in both the villages at the collective level. In other words, the sufficiency of the water was not related to the position of the farmers on the watercourse.

Table 2 Timely Availibility of water Verses Location of the farmers on the watercourse
Unit :-(Number, Percentage)

kharif 1989	Mashugager Village			
	50% on time	Rarely on time	Never on time	Row total
Head 1	9	1		10
	90	10		33.3
	52.9	9.1		
Middle 2	7	3		10
	70	30		33.3
	41.2	27.3		
Tail 3	1	7	2	10
	10	70	20	33.3
	5.9	63.6	100	
Column Total	17	11	2	30
	56.7	36.7	6.7	100

Results:-	Chi-square	D.F	Significance
	15.2085	4	0.0043

Table 3

According to Table 4, in all five suggestions were made. Regular repairing and weed control were more important in Telaband than in the Mashugager on watercourse maintenance work. Regular cleaning and weed control were more imprtant for field channels in Mashugager while regular repairing was more important in Telaband.

Table 3 Water Sufficiency Verses Location of the Farmers Watercourse (number, percontage)

Kharif 1989	Mashugager Village			
	1/2 sufficient	1/4 sufficient	1/4 sufficient	Row total
Head 1	7	3		10
	70	30		33.3
	43.8	23.1		
Middle 2	7	3		10
	70	30		33.3
	43.8	13.11		
Tail 3	2	7	1	10
	20	70	10	33.3
	12.5	53.8	100	
Column Total	16	13	1	30
	53.3	43.3	3.3	100

Results:-	Chi-square	D.F	Significance
	7.58654	4	0.108

Table 4

The major objective of this study is to investigate the research system operation and maintenance at the farm level. Research findings on different objectives of study are presented as

Table 4 Suggestions for the Maintenance of Watercourses and field channels by villages
Unit : - Number

Suggestions	Mashugager village		Telaband village	
	Water course	Field channels	Water course	Field channels
1. Regular cleaning	26	22	30	21
2. Lining	20	5	22	2
3. Regular repairing	11	6	7	16
4. Weed control	3	23	1	21
5. Rodent control	0	4	0	0

follows. The first part consist of the socio-economic characteristics of the water users i.e. the farmers in the two villages. The second part consist of the findings of the two villages.

(1) Social and Economic Characteristics of the Waterusers

The major occupation was farming and the farm experience was more than 35 years for the farm owners and 32 years for the farm tenants in Mashugager village while 32 years for both the farm owners and tenants in Telaband. Elkady and Eldon Hadson reported that the irrigation system in Egypt needed tremendous efforts and funds for the rehabilitation and moderinisation in order to solve its complex problems of operation, maintanance control and management, irrigation deliveries were reported to be as low as 14 to 20% of the irrigation requirements.[7] The size of the family owners was 11 and of farm tenants 9 in Mashugager while in Telaband it was 9 and 7 persons respectively. The average age for the farm owners was 56 and of farm tenants 52 in Mashugager while it was 50 years for the farm owners and 53 years for the farm tenants in Telaband. All of the water users were illetarte except two tenants in Mashugager and and one farm tenant who had read upto primary standard. The average size of the family of the farm owners was 1 and of farm tenants 9 in Mashugager while in Telaband it was 9 and 7 persons respectively. The minimum land leased in by the tenants varied between 1 hectare and a little over 4 hectares in both Mashugager and Telaband. It seemed that both of the water users belonged to the category of small farmers cultivating about 4 hectares on the selected water course. Freeman et al showed that the average farmers lose more than half of the water before it reaches to root zone of their crops. The farmers at the tail of the system lose more than the head farmers.[8]

(2) Farm Irrigation System Operation

The farmers operate the farm irrigation system for the common benefit of all water users as the water leaves the outlets and flows into the watercourse. The irrigation turn known as Warabandi in the local language are operated on weekly basis. The time per week allocated to any farmer is nearly proportional to the percentage of the land holding held by a farmer. The warabandi does not imply that equal amount of water will be delivered to all those at the head or at the tail of the watercourse. The warabandi was informal in the beginning in both the villages. It was decdied by the farmers themselves by common consensus. But this could not be maintained for a long due to frequent quarrels or buying and selling land among themselves. The villagers therfore applied for the official warabandi at different periods of time. The Divisional officer called up all the share holders to a meeting and arranged the duration of their turns in accordance with their areas in the rotation register. The official warabandi started in Mashugager in 1979 and in Telaband in 1989. Jean Pierce et al found that there was little participation by the majority of the small farmers in meetings of associations. They noted that water users were controlled entirely by the one large landlord in several cases.[9]

6. Remarking Conlusion

The Warsak Lift Canal is currently facing several problems. These problems relate to wear and tear of the pumps at the pumping house,

frequent break down due to lower production, accumulation of silt, unauthorised canal outlets, seepage problems etc. This resulted in water shortage at different points in the conveyance system. The research findings showed that more water was available at the head than at the tail village, more water was available at the head of the watercourse than at the tail location of the watercourse. The upkeep of the entire watercourse level resulted into the tragedy of the commons. Reliability of the Irrigation water delivery is the extent to which the Irrigation water is received at the canal outlet in accordance with the rules. The responsibility of the Irrigation Department is to deliver reliable and equitable supplies to all the canal outlets. The Warsak Lift Canal Irrigation Division needs to manage effective water control over the allocation and the use of the water for the benefit of all water users.

7. Recommendations

The following recommendations were made to improve he efficiency of the Warsak Lift Canal system and thus to improve the irrigation system operation and maintenance of water courses and field channels for the benefit of all water users in both the villages.

1) The Warsak Irrigation Division should manage the water supplies in the canal for the benefit of all water users. It is important to replace the pumps and clear the silt in order to restore its designed discharge of 200 cusecs.
2) The waterlosses, leekage, over topping, siltation, weed control must be reduce to make more water for irrigation at the farm level. Regular removal of silt, maintenace and cleaning of watercourses and field channels will improve the conveyance efficiency of the irirgation system.
3) The application efficiency of irrigation water at the level must be improved through the irrigation water at the farm level must be improved through the scientific management of irrigation water.
4) Farmers should be trained to practise precision land levelling in the village. The extension work should concentrate on improved water management technique in the area and teach the judicious use of water.
5) The WUAs should be developed along democratic lines. They should give social participation to all members so that the benefits are equally distributed to all members. They should work togeter with the OFWM (On Farm Water Management), irrigation department and the agriculture Department for the development of irrigated agriculture.
6) The Command Water Management Mangement should provide both water and non-water inputs for the irrigated agriculture to all water users in the area.
7) Finally, the Governmernt should provide reasonable input and output prices for the devlopment of irrigated agriculture.

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