IRRIGATION SYSTEMS MANAGEMENT RESEARCH (ISM/R) PROJECT

FINAL REPORT

ENCOURAGING WATER USERS ASSOCIATIONS

- Pre Project Socio-Economic Study for the Action Research Program on Encouraging Water Users Associations at Qadirabad and Bara Drush Khela Research Sites - Part I
- Action Research Plan of Encouraging Water Users Association at Qadirabad and Swat - Part II
- Potential Role of Water Users Associations for Better Water Management at the Farm Level: Synthesis of Nine Studies

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REPORT ON

PRE PROJECT SOCIO-ECONOMIC

STUDY FOR THE ACTION RESEARCH

PROGRAM ON ENCOURAGING

WATER USERS ASSOCIATIONS

AT

QADIRABAD

AND

BARA DRUSH KHELA

RESEARCH SIDES

PART - I

A

Pre Project Socio-economic Study for the Action Research Program on Encouraging Water Users Associations at Qadirabad and Bara Drush Khela Research Sites

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ABSTRACT

This paper presents the pre-project survey results and analysis of the action research program on encouraging water users associations for better water management. This program studies the dynamics of water users associations having greater management responsibility.

The study sought to obtain in-depth knowledge on the ability and willingness of the irrigation community to assume greater responsibility for water management with a high level of community participation. The purpose for this study was to help prepare different phases of community involvement in the action research program and also in subsequent system operation and management. The impact of their involvement in the planning phase of better water management will be studied in greater detail later.

Qadirabad, in District Gujranwala, Punjab Province, and Bara Drush Khela, in District Swat, NWFP, are the two selected study sites. The study methodology used was field survey research including interviews with non-random informants and respondents, and systematic field observations.

The educational standards of interviewees at both sites were encouraging. Most of the farmers own their landholdings, albeit small. Most of farmer families at both sites are large, which is typical of the demography in irrigated areas of Pakistan. At both sites, the water users show interest in the formation of water users association and in the planning and development of technical inputs (structural and non-structural). The study sites offer good opportunity to test different types of socio-economic criteria for the formation of effective and viable water user associations.

INTRODUCTION

Water management programs in Pakistan are funded on the basis that the water users associations exist for sharing common irrigation facilities. However, these associations have not achieved the desired results. Due to the lack of water users participation and co-operation, the benefits of water course improvement are not realized significantly. Active user participation for better water management would:

a) Create proper understanding of the dynamics of watercourse organization;

b) Enable regular monitoring and evaluation of water users association; and

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c) Help identify and then remove institutional constraints impeding the establishment of water users associations.

Realizing the importance of the above factors for improving water management programs, the Pakistan Council of Research in Water Resources (PCRWR) conducted nine research studies in the heterogenic cultures of all four provinces as well as northern areas of Pakistan. The studies were undertaken under the Encouraging Water Users Involvement for Better Water Management (EWU) sub-component of the Irrigation System Management (ISM-R) Project supported by USAID. These studies provided basic data about the formation, functioning and management of water users associations, and came to the common conclusion that user associations can be highly instrumental in effective water management programs (Chandio et al., 1993).

As a follow-up to these studies, PCRWR launched an action research program to determine the ability and willingness of the community to take project responsibility, and to try new strategies to encourage water users associations. This follow-up is based on the theory that success would depend on three factors: a high level of community participation in all phases of project development; the existence of a local organization capable of carrying out irrigation tasks that are best performed locally; and agency policies and behavior supporting or, at a minimum, tolerant of local control (Lynch, 1985).

Two project sites have been selected for this action research program. One is at Qadirabad, District Gujranwala in Punjab province and the other at Bara Drush Khela, District Swat in NWFP province, the two sites being inside and outside the Indus Basin irrigation system, respectively. In this action research program, technical inputs for both physical and non-physical infrastructure changes form the motivating base for farmer organization.

An important feature of both study sites is that the water supply is not from government sources; it comes from local projects. In Qadirabad, the irrigation water comes from the effluents of the tile drainage schemes and augmented by tubewell water. Therefore, the water users are responsible for the proper operation and maintenance of the drainage project. Similarly, in Bara Drush Khela, the irrigation water comes from a farmer operated and maintained system, including a diversion structure at river Swat, channels and a irrigation storage tank to be constructed on the hilltops. This particular characteristic in both study sites, where the user makes decisions for better water usage, is expected to facilitate the action research program.

The economic, social, institutional, administrative and technical data collected before and after the project interventions will provide a basis for understanding the mechanisms and dynamics of water users associations. This paper presents the results of the pre-project, socio-economic survey of the two study sites.

OBJECTIVES

The action research program has the following objectives:

a) Understand the processes and mechanisms of cooperation among farmers for better water management (with less institutional constraints) by collecting the pre- and post-project

socio-economic and technical data.

b) Mobilize farmer's cooperation for the formation of effective water users associations.

c) Regularly monitor and evaluate water users associations' role in decision-making, operation and maintenance of the system.

d) Develop and introduce an appropriate water management and crop-rotation system with the help of water users and relevant agencies, for optimum agricultural production.

e) Develop policy guidelines based on the results of the action research program.

RESEARCH METHODOLOGY

Pre-Project Socio-Economic Study

The research team made a reconnaissance survey of both study sites and had informal discussions with water users, local leaders and field level officials. These informal meetings helped gain a preliminary understanding of the study areas and develop the survey instruments. Three different proformas were developed for collecting socio-economic and technical data. They are:

1- Farmer/House Hold Profile
2- Leader/Key Informant Perception
3- Village Profile

The Farmer/House Hold Profile Proforma is for information about farmers and their families, social background of the study area, land, crop production, irrigation, family income from agriculture and related economic pursuits within the study area, family expenditure, and perceptions on project interventions. The Leader/Key Informant Perception proforma is for general information on the area, about socio-economic conditions, agriculture, irrigation, decision-making patterns, existing village organizations, any NGO involvement, previous efforts in farmer organization, and ideas about project interventions. The Village Profile is for information on ethnic composition, land tenure, irrigation systems, constraints on production and welfare, farmers' participation patterns, and leadership patterns.

Procedure for collecting field data included both survey research methods with non-random informants' and respondents' interviews and systematic field observations. Structured interviews were conducted on the basis of a pre-designed interview schedule using the first proforma, involving all the farmers in the selected study areas, and unstructured interviews with other well-informed people using the other two proformas. The proformas were tested in the field conditions at Qadirabad site and some modifications were made.

Study Sample

In Qadirabad site, 30 farmers own land in Block No. 6, the selected study area. Out of these, 24 were interviewed. Four respondents are residents of village Kot Hara and 20 reside in village Hazrat Kelian Wala. These villages are two kilometers apart.

In Bara Drush Khela site, 24 farmers acquiring water for irrigation from the same diversion channel from river Swat were interviewed. All reside in the Bara Drush Khela and were interviewed.

Action Research

Technical, social, economic and organizational indicators will be established to evaluate system performance. The system will be equipped with drainage and irrigation infrastructure in the case of Qadirabad, and only irrigation infrastructure in Bara Drush Khela. Water Users Associations will be formed if they do not exist in the area. In either case, these organizations are prerequisites to the proposed action research program since the users are expected to share around 40% to 50% of the capital cost of the project and have to bear the subsequent costs of operating and maintaining the physical systems.

In the project implementation phase, in which the water users and the other sections of the village community will be involved in collaboration with relevant government agencies, the following technologies will be introduced :

- to clear the surface drains and construct new ones, if necessary, at Qadirabad site
- to install tile drains at Qadirabad site
- to reuse the drainage effluent at Qadirabad site
- to construct appropriate diversion structures at project site on river Swat at Bara Drush Khela
- to brickline the water courses as per practice of the on-farm water management department at both research sites
- to develop and introduce appropriate new water management and crop rotation systems for optimum production at both research sites

After these technologies have been introduced, mechanisms to use them will be demonstrated. The importance of the end user's participation in the activities will be emphasized. After the technology intervention, the following will be monitored, where applicable:

1) operation of the water distribution system
2) operation of surface and sub-surface drainage systems
3) tubewell operation and reuse of drainage effluent
4) maintenance of drains, channels, watercourses and tubewells
5) crop rotation system and crop production
6) organizational behavior patterns and decision-making processes
7) socio-economic changes with respect to technology intervention

Since the maintenance of the systems has to be carried out by the users themselves, their participation in the process as a whole will be closely

monitored. This will help gain intimate knowledge of the issue and constraints of organized behavior at the farm level, and of group decision-making processes.

Post-project monitoring will also be conducted to identify the problems and appropriate solutions for organizing Water Users Associations in relation to the interventions during project implementation.

MATERIAL PRESENTATION AND ANALYSIS

Education

A low literacy rate in developing and underdeveloped countries is the main hindrance in realizing full benefits of development programs. The difficulties in promoting new ideas, such as popular participation in development efforts, must be understood in the context of the educational levels of the participants.

The educational status of the respondents in Qadirabad site is presented below:

Qadirabad Site

1.	No Education	3	13%
2.	Primary	7	29%
3.	Middle	6	25%
4.	Secondary	7	29%
5.	Higher Secondary & above	1	4%
	Total:	24	

At Bara Drush Khela site, the average literacy rate is not as high as at Qadirabad but the number with higher education is greater as can be seen below:

Bara Drush Khela Site

1.	No Education	11	46%
2.	Primary	6	25%
3.	Middle	3	12%
4.	Secondary	-	-
5.	Higher Secondary & above	4	17%
	Total:-	24	

Relative to conditions elsewhere in Pakistan, the educational standard in both areas seems to be encouraging and can be considered a bonus in the effort to organize the Water User Associations and promote other technical interventions.

Family Pattern

In rural society, the family plays a significant role in decision-making, particularly when decisions have to be made by individuals for collective behavior.

The family pattern in both research areas consists of joint and nuclear families. At Qadirabad site, out of the 24 respondents, 11 live in the joint-family system. Maximum size of the joint family is 37; the average size is 19. Maximum size of nuclear family is 14; the average is 5.6. According to local information, the proportion of nuclear families in the total number of families in the village (54.17% in the sample) reflects the trend that the joint/extended family concept is declining in this largely agrarian society.

In Bara Drush Kheia site, the joint family system is still strong, reflecting the greater adherence to tradition seen in the northern areas. Out of 24 families, 17 are joint and seven nuclear. Maximum size of the joint family is 30; the average is 15.4. Maximum size of the nuclear family is 16; the average is 9.

The data show that the size of the joint families is fairly large in both sites, which tends to exert a heavy burden on the limited land, water and other local resources. The relatively large nuclear family size at both sites also adds to this tendency.

Caste/Kinship and Tribal System

Caste or Kinship (local co-resident group) is based on a combination of patrimonial descent and marriage (see Alvi, 1972). The cast system plays an important role in the rural Punjab (Mirza, 1990). Lynch (1985) suggests that homogeneity of the water users enables their water user association to reduce conflicts that stem within a community from a diversity of local interests, whereas the heterogeneity within the population reflects class or ethnic cleavages. Diverse sectoral interests weaken the potential for active participation in water management.

In Qadirabad site, the majority of the respondents (58%) belong to Bukhari caste, a sub-caste of Syed. The other major caste of the respondents (38%) is Jat with its sub-castes of Cheema, Chattha, Warria and Tarrar.

Syed and Jat are rival groups in local politics. Even the village Hazrat Kelian Wala has been bifurcated on caste basis; one side of the village is occupied by the Syed group and the other by the Jat group. During the discussions, the Syed informants repeatedly showed their dislike toward the Jat clan, while the latter indicated their unhappiness with the Syeds.

In Bara Drush Khela, the majority of the respondents (79%) belong to Pathan (Yousafzai Tribes). The other group (21%) is Syed family (Tribe).

The Pathan and Syed in Bara Drush Khela are not as rival to each other as Syed and Jat in the Qadirabad study area.

Landholding and Land Use

Possession of land is linked with many latent and apparent socio-economic advantages: it is a source of social status, of group identity and cohesion; it helps to gain political power and provides subsistence (Khan, 1990).

Qadirabad Site

Table 1 gives information on landownership pattern of farmers in the Qadirabad site and the landholding pattern in the study area. Twenty-four families possess 446.25 acres of land with an average of 13.59 acres per family. Of the total extent, the major portion (74.8%) is uncultivated. The average cultivated landholding is about 9 acres; the largest is 80 acres. The second and third largest holdings are 50 acres and 48 acres. The smallest landholding is only 3.25 acres. The second and third smallest landholdings are 4 acres and 4.5 acres. The land is used for crop production and fish culture. Most of the farmers are owner-cultivators.

Two inter-linked reasons have been reported for the large amounts of uncultivated land in the area: waterlogging and salinity.

Waterlogged area: Being close to the river Chenab, this area suffered from waterlogging since before the sub-continent partitioned. But the problem has been exacerbated manyfold by the construction of Qadirabad Balloki link canal and the erection of Qadirabad Barrage in the 1960s. Since then, the problem has gradually increased in intensity. According to the latest survey, out of 446.25 acres, 222.75 acres are waterlogged, constituting 66.47% of the uncultivated land. The average waterlogged landholding is 13.92 acres. Waterlogging is the main reason for non-cultivation, and because of poor agricultural activities, the farmers cannot get a second crop from their land.

Saline Area: In Qadirabad site, out of 446.25 acres of land, 111 acres are reported saline. This constitutes 24.87% of the total land and 33.26% of uncultivated land. The average saline landholding is 10.09 acres. The eastern portion of the project area has become nearly barren because of the saline problem. The salinity can be observed from a distance. The watertable in the saline lands is high, thus waterlogging occurs as well.

Bara Drush Khela Site

In Bara Drush Khela, 24 respondents reported having a total of 672.5 acres of land with an average of 28.02 acres per family as shown in Table 2. The cultivatable land is 354.5 acres in extent, i.e. 52.71% of the total land, and is being cultivated by owner-farmers. Average cultivatable landholding is 14.77 acres. Of the total extent, 47.29% land cannot be farmed.

The largest landholding of 24 respondents is 500 acres. The second and the third largest is 55 acres and 12 acres. The smallest is one acre. The second and the third smallest holdings are 1.5 acres and 2 acres.

Cultivatable Land

Qadirabad Site

At Qadirabad site, out of 446.25 acres, 112.5 acres of land are cultivatable in the project area. The cultivatable land is owned by 12 farmers. The average cultivatable landholding is 9.375 acres. The largest cultivatable holding is 20 acres; the second and third largest are 15 acres and 14 acres. The smallest cultivatable landholding is 1 acre; the second and third smallest holdings are 3 acres and 4 acres.

Distribution of the cultivated Land

1 to 5 Acres	=	4
6 to 10 Acres	=	4
11 to 15 Acres	=	3
16 to 20 Acres	=	1
Total:		12

It is reported that the cultivatable land is also affected by waterlogging. The watertable is very high; at some places it is about six to nine inches.

As stated, the size of landholding is very small, the fertility of the soil has been affected, crop intensity and yields have been reduced, the quality of the crop production has also deteriorated: due to all noted factors the cultivated land seems not to be a good source of subsistence for the farmers.

Bara Drush Khela Site

In Bara Drush Khela, out of 672.5 acres of land, 354.5 acres is cultivatable. The cultivatable land is owned by 24 respondents. The average cultivatable landholding is 14.77 acres. The largest cultivatable landholding is 250 acres. The second and the third largest cultivatable holdings are 30 acres and 8 acres. The smallest cultivatable holding is one acre. The second and the third smallest cultivatable land holding are 1.5 acres and 2 acres.

Distribution of the cultivatable land

1 to 5 Acres	=	19
6 to 10 Acres	=	3
11 to 30 Acres	=	1
31 and above (250 Acres)	=	1
Total:		24

Fish Ponds

As the Qadirabad research indicates, local lands do not produce much in terms of agriculture. Thus, the landowners use their discretion to find other sources of income. Regional farmers, who are relatively better placed in their economic conditions, are constructing fish ponds. There are two fish ponds in the area. Both fish ponds are over half acre of land each and are five to six feet deep. Water in these fish ponds is provided by he diesel-operated tubewells.

Crops Production Profile

Qadirabad Site

As can be seen in Table 3, there are two major crops in the Qadirabad project area, rice in Kharif season (sowing in April-May; harvesting in October-November) and wheat in Rabi season (sowing in November-December; harvesting in April). Rice grown area covers 102.5 acres and Wheat, about 80.5 acres. Besides these major crops people grow fodder in Rabi season at a limited scale and, similarly, some vegetables and sugarcane in Kharif season.

Table 4 gives a summary of the data gathered from the respondents regarding area under crop, cost per acre per crop, total cost per crop, yield per acre, total yield, and the income per acre for different crops. The average yields are fairly low; the yield of wheat is 19 maunds (mds) per acre and that of rice is 23 mds per acre. The average income from wheat per acre is Rs. 1311 and from rice it is Rs. 1925 only. The net income from the fodder and other crops appears to be negative.

Table 5 shows that the average cultivatable landholding size and the profit of crop per acre are both small in the Qadirabad area. Table 5 gives the total cost of agricultural activities and household expenditure, total income from agriculture output and from other sources, profit of the individual farmer/respondent, and the average income, average expenditure and average savings. Interestingly, as many as 10 respondents report their agricultural and household expenditure is more than their respective total incomes from the land, and consequently the total savings for the 24 respondents become a negative quantity (-Rs. 122, 442). This apparent deficit can be attributed to the fact that the reported income, based only on agriculture and land-oriented activities, excluded earnings of family members working off the land. The reported household expenditure are partly supported by outside earnings. The figures indicate, however, that the system in itself is not sustainable.

Bara Drush Khela

At the Bara Drush Khela site, most of the cultivatable land is under apple orchards and it is considered here as Kharif crop as per Table 6. Farmers grow both Kharif and Rabi crops. In Kharif season, the other major crops are rice and maize which occupy about 30% of the total area. In Rabi season, wheat, onion and fodder are grown. The average yield of the rice is 31.25 maund per acre and of maize 75.75 maund per acre. Among Rabi crops, the average wheat yield per acre is 43 maunds. The data regarding agricultural economics are presented in Table 7. Apple orchards earn the most for farmers. On average, 23.65 acres are for apple production which earn farmers Rs. 32,050 per acres. The net income from rice, wheat and onion is Rs. 8,765, Rs. 3,458 and Rs. 12,955, respectively.

Respondents' total income and expenditure data are presented in Table 8. The average savings per family is Rs. 285,290 and per person is Rs. 210.68 [illegible] the economic conditions in the study area are good, but the observations and discussions in the field indicate potential to improve these conditions.

Irrigation

Irrigation is [illegible] three-way relationship of man/land/water in a temporal dimension (Spooner, 1974). Uphoff, Meinzen, Dick and Julien (1985) have suggested that "irrigation should be understood as a socio-technical process combining people and material things." The combination of a set of relationships and socio-technical processes of irrigation forms the lifeline for an agricultural society.

Qadirabad Site

Table 9 presents the respondents' use of irrigation sources and

irrigation methods in the area.

The Qadirabad project area is situated between river Chenab in the west, Qadirabad - Balloki link canal in the south and the lower Chenab canal in the north. A fully operating minor, Ram Nagar minor, existed in the area before the construction of the link canal. Ram Nagar minor has a sub-minor, namely Kot Hara sub-minor, which lies in the project area. The water supply is not reliable, being only available in the rainy season. Although the Irrigation Department does not operate the minor or the sub-minor regularly, the farmers are charged an Ablana (water tax) of Rs. 35 to Rs. 40 per acre regularly.

The majority of the farmers at Qadirabad site have private tubewells and water pumping machines, the only reliable irrigation sources in the area. As shown below, the respondents use tubewells in both Kharif as well as Rabi seasons.

Tubewell Irrigation (in acres)

	Kharif	Rabi
Total	104.5	94
Average	9.5	7.33
Percent of Cultivatable Land in Qadirabad	92.89	83.55
Percent of Total Land Land in Qadirabad	23.41	21.06

In Qadirabad, the minor is used for irrigation only in the Kharif season when rice is cultivated. Out of 112.5 farmable land, only 34 acres is occasionally served by supplemental irrigation from the minor. But the quantity of water varies at each supply. In fact, the quantity depends upon the intensity of rains. When more rain falls in the area the water in the minor increases. There is no irrigation from the minor in the Rabi season.

Bara Drush Khela

River Swat is the main source for irrigation practices in the Bara Drush Khela research site as shown in Table 10.

A diversion bund (Check Dam) exists at the river and a big pakka structure to receive the river water has been constructed by the farmers on a self-help basis; from that channel, water feeds the whole village. Many distributaries come from the main channel to irrigate the farms. This channel flows throughout the year except for a short period after rainy season. This water course is cut across by three hilly nullahs (streams); in the rainy season, rain water flows in these streams at a high velocity, damaging the watercourse. Also, the rains cause the river Swat to flow at full speed (like a flood) over its banks. The high speed water very often damages the diversion bund. When the river comes to normal, due to the broken diversion, the channels do not receive water from the river. As soon as the rain is over, the people rush to repair or reconstruct the diversion bund and the watercourse and whatever else needs to be done. All the beneficiaries of the watercourse provide labor and finances for the repair and maintenance work.

In Bara Drush Khela, irrigation from the Swat minor is done for both Kharif and Rabi Season. All 24 respondents receive irrigation water from the watercourse (minor). The average landholding at this watercourse is 13.46 acres. The minor irrigated lands of 24 respondents constitute 91.11% of the total cultivatable land.

In Bara Drush Khela, besides the land watered by minor irrigation, people have some rainfed land as well. The rainfed land constitutes 8.89% of the total cultivatable land of 24 respondents. The average rainfed land is 3.5 acres. Farmers grow both Kharif and Rabi crops in the rainfed land.

In Bara Drush Khela, some respondents are trying to use water storage tanks to irrigate their rainfed lands and to bring some of their uncultivated land under cultivation. One such system is already working in the area. A 40'x50'x5' pakka tank has been erected at high altitude. To fill this tank, water is run through a 3 inch diameter pipe from a natural spring one and half kilometers away in the high hills. From the tank, a small lined pakka distributary is constructed which runs to the fields half kilometer from the tank. Considering it a model, some other respondents want this type of irrigation system for their rainfed lands.

Methods of Irrigation

Two irrigation methods, i.e. basin and wild flooding, are being practiced in the Qadirabad area. In the basin irrigation method, farmers prepare small plots of one or two canales and irrigate them. In the study area, eight respondents use the basin method of irrigation in their 75.5 acres of cultivatable land. Of the 24 respondents, nine use the wild flooding method in 80.5 acres of cultivatable land. In flooding method, farmer's plot size is approximately one acre and above.

In Bara Drush Khela for the orchards, respondents use the furrow method of irrigation, and for soybean and sarsoon, cultivated in orchard land, they use wild flooding method of irrigation. For the rest of the crops the basin technique is used. The percentage of land under the basin method is 33.29%, with 59.10% under the furrow method, and 7.61% under the wild flooding method of irrigation.

Project Interventions

Qadirabad Site

The research area at Qadirabad is facing severe waterlogging and salinity problems which have left almost 75% of the area un-cultivatable. Further, the cultivatable land also is subject to the effects of waterlogging. In view of the severity of the problem in the area, the Drainage & Reclamation Institute of Pakistan (DRIP), Tandojam has prepared a project for the installation of tile drainage system to control waterlogging. Physical work to be done includes cleaning and renovating the surface drains, constructing a pumping system to reuse drainage effluent, improving the partly used minor and developing watercourses to increase the area under irrigation.

During field visits to the research site, discussions, emphasizing the value of their participation, were held with the farmers. Also topical was

that when decisions on means and shares of the local resources are made by the users themselves, the projects are more successful. (Uphoff, Meinzen, Nancy and Julian, 1985). Efforts were made to help farmers to understand the proposed innovations, participate in construction, and contribute capital cost of improvements. The respondents agreed on the concepts of the projects, but their poor financial circumstances appear to be the main hindrance to their agreeing to share the 30% capital cost of the project. According to the respondents their agricultural lands are hardly giving them subsistence to pull their life, and therefore, they are unable to share any cost. However, the majority of the users showed their willingness to provide labor for the project. Korten (1982) said that one kind of farmer participation often overlooked and not encouraged is in the planning and operation stages. Discussions were held with water users regarding their participation in the construction, planning and operation of watercourses, and the need for them to prepare taking over management of the physical systems improved by the project. They agreed to participate in the formation and the smooth running of the Water Users Associations.

Bara Drush Khela Site

In the Bara Drush Khela site, PCRWR has designed a project under EWU action research program to construct the lined and pakka water courses, pakka diversion bunds in the Swat river and to form the Water Users Association (WUA) for better water management.

During the field work, the EWU research team explained to the local farmers about the project interventions and sought their opinion about the launching of the project. Almost all the farmers were found willing to accept the project. A majority of the respondents agreed to share 40% of its material cost. Some of the respondents wanted others to pay first before they would share the cost, while a very few, due to their very weak economic conditions, doubted they could share costs. However, they were ready to provide physical and moral support for the project.

Farmer Perceptions on Water Users Associations (WUAs)

In his remarkable work on users' participation in irrigation, Lynch (1985) suggested "physical environment, community social structure, regional and national economic and political structure will have a pronounced impact on level and forms of participation and effectiveness of local organizations."

One of the most important objectives of forming Water Users Associations is to promote community participation in resolving complex social problems. Information was sought regarding existing organized behavior, to assess the potential of meeting this objective. These data along with information on existing mechanisms for conflict resolution and farmers' perceptions on WUAs were collected from both the project sites. Results are presented in Table 11 for Qadirabad and in Table 12 for Bara Drush Khela site.

In Qadirabad site, only two of the 24 farmers interviewed, are members of some kind of local organization. During the last year, only two water-related disputes were reported. Out of those two disputes, one was resolved mutually by family members, while the other resolution involved some government functionaries.

Twenty-two farmers were willing to form the organization and their intended cooperation can be seen in the following:

Sr.No.	Cooperating Mechanism	No. of Farmers
1.	Sharing the cost substantially	0
2.	Sharing the cost marginally	0
3.	Cost sharing subject to conditions	15
4.	Only through labor	7
5.	Only through material	3
6.	Contribution depending upon political decision	3

All the farmers wanted to play some role in organizing the community. The roles they are willing to play are tabulated as:

Sr.No.	Role	No.of Farmers
1.	Being the Committee Member	10
2.	Being the Ordinary Member	12
3.	Helping the Agency Personnel	3

In Swat site, out of 24 farmers only one is a member of some kind of local organization. Eight water-related conflicts had been reported during the last year. Five conflicts were resolved mutually with some interference or involvement of family members; the other three needed government functionaries involved.

All the farmers wanted to be a part of the proposed WUA. Their intentions for cooperation were as follows:

Sr.No.	Cooperating Mechanism	No. of Farmers
1.	Sharing the cost substantially	17
2.	Sharing the cost marginally	1
3.	Cost sharing subject to conditions	5
4.	Only through labor	1
5.	Only through material	0
6.	Contribution depending upon political decision	1

Except for one, all the farmers wanted to play some role in organizing the community. The roles in which they are interested are as follows:

Sr.No.	Role	No.of Farmers
1.	Being the Committee Member	7
2.	Being the Ordinary Member	12
3.	Helping the Agency Personnel	3

Despite knowing the importance and effectiveness of water users association in water distribution and allocation, water related dispute settlement, watercourse improvement, maintenance and management, etc., the local farmers have not tried previously to form these organizations. Realizing the benefits, the users are willing to form the water users association under

the guidance and supervision of some government agency because they do not know how to form an organization. They agreed to participate in the running of a viable water users association. Improved water distribution is always welcomed in principle by almost every one. They also perceive the benefit of operating water course through their WUAs because they think that the success of the program will improve their deteriorating economic and social conditions.

In Bara Drush Khela, all the small farmers agreed that the WUA should be formed and they should help run the WUA affairs. They acknowledged that WUA would be a great help in increasing the mutual cooperation and understanding among the water users. Consequently, they feel, matters related to water distribution, watercourse maintenance and management will be taken more systematically.

Leadership Pattern

"The function of leadership is to plan and organize decision making, resource mobilization and management, communication and conflict management, though not necessarily to carry out personally" (Korten, 1982).

At the Qadirabad site, an ambiguous local leadership pattern was perceived during the preliminary investigation. Twenty-four respondents with diverse ethnicity (different kinships) named at least 16 people as their leaders. In fact, each clan and sub-clan, even the family, consider their own elder or financially sound person as the leader. However, five people, two from Syed group, two from Chattha and one from Cheema clan, were finally identified as community leaders. The influence of these leaders was observed when most of the farmers who had halfheartedly agreed to share some material cost of the project finally refused to share any cost after the leaders objected to the idea of cost sharing. These leaders wanted the government to carry the entire cost of the project. The leaders had no objection to sharing the labor cost through the Water Users Associations in their areas.

Elite leadership patterns through inheritance exists in the Bara Drush Khela. The largest landholding person appears to have the highest political, socio- economic status. He also has a good number of individual supporters, hence he enjoys a power status in the society. Village decision-making and authority revolves around him. The leadership of the area was interested in the project, especially in introducing larger water storage tanks and in making a permanent arrangement of a diversion bund at the river and in improving the watercourse which as it is now, gets damaged during rainy seasons.

CONCLUSION

The concept of action research program provides an excellent opportunity to study in detail the dynamics of Water Users Associations with greater management responsibilities. The relatively high literacy rate in the area, kinship patterns, the common belief that technology provides benefits, the willingness of farmers to organize Water Users Association and share labor costs, are the issues which will be observed and tested through action during the study program.

In Qadirabad, tubewell and proposed drainage effluents are the major sources of irrigation. All the farmers perceive economic benefits from the project installation and want the work completed as soon as possible. Some of the farmers were willing to share some material costs but local political pressure caused them to change their minds. The farmers however, are ready to cooperate in forming water users associations under the supervision of some government officials, and also are willing to provide labor for the physical work. Upon completion, the WUA is expected to take over the operation and maintenance responsibilities of the system.

In Bara Drush Khela, farmers perceive better irrigation management and economic benefit from the project and desire that work should be completed as soon as possible. Majority of the respondents are willing to share the cost and provide labor. Local political leadership also supports the project. After completion of the project, WUA will take over the project's operation and management.

Monitoring the organized behavior of water users will be continued throughout the project period, allowing in-depth knowledge to be gained regarding the formation and functioning of water users organizations in the region.

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Table 1. Total landholding with cultivatable and un-cultivatable land in the Qadirabad project area

FARMER NO.	TOTAL LAND HOLDING					LAND HOLDING IN THE PROJECT AREA				
						PROJECT AREA				
								UN-CULTIVATABLE LAND DUE TO		
	AS OWNER	AS TENANT	BY TENANT	TOTAL	CULTIVATABLE	UN-CULTIVATABLE	TOTAL	WATER LOGGING	SALINITY	WATER SHORTAGE
1	12.0	-	2.5	14.5	-	5.5	5.5	5.5	-	-
2	60.0	-	-	60	15.0	-	15.0	-	-	-
3	24.0	-	-	24	4.0	8.0	12.0	8.0	-	-
4	28.0	-	-	28	8.0	20.0	28.0	13.0	7.0	-
5	24.0	21.0	-	45	-	15.0	15.0	-	15.0	-
6	25.0	-	-	25	12.0	5.0	17.0	3.0	2.0	-
7	50.0	100.0	-	150	-	50.0	50.0	30.0	20.0	-
8	26.0	7.0	-	33	-	6.0	6.0	2.0	4.0	-
9	80.0	-	-	80	20.0	60.0	80.0	60.0	-	-
10	17.0	-	-	17	10.0	7.0	17.0	-	7.0	-
11	15.0	-	-	15	-	10.0	10.0	-	10.0	-
12	47.0	-	-	47	-	26.0	26.0	26.0	-	-
13	25.0	-	-	25	-	17.0	17.0	17.0	-	-
14	10.0	-	-	10	-	7.5	7.5	-	7.5	-
15	104.0	-	-	104	5.0	4.5	9.5	4.5	-	-
16	60.0	-	-	60	10.0	-	10.0	-	-	-
17	5.0	-	-	5	3.0	2.0	5.0	2.0	-	-
18	9.0	-	-	9	-	4.5	4.5	-	4.5	-
19	3.3	-	-	3.25	1.5	1.75	3.3	1.75	-	-
20	10.0	-	-	10	-	4.0	4.0	4.0	-	-
21	48.0	-	-	48	14.0	34.0	48.0	34.0	-	-
22	25.0	-	-	25	-	20.0	20.0	10.0	10.0	-
23	45.0	-	14.0	59	-	24.0	24.0	-	24.0	-
24	25.0	-	-	25	10.0	2.0	12.0	2.0	-	-
TOTAL:-	777.25	128.00	16.50	921.75	112.50	333.75	446.25	222.75	111.00	0.00
AVG:	32.39	42.67	8.25	38.41	9.38	15.17	18.59	13.92	10.09	0.00

able 2. Total landholding with cultivatable and uncultivatable land in Bara Drush Khela project area

FARMER NO.	TOTAL LANDHOLDING				LANDHOLDING IN THE PROJECT AREA					
								UN-CULTIVATABLE LAND DUE TO		
	AS OWNER	AS TENANT	BY TENANT	TOTAL	CULTIVAT-ABLE	UN-CULTIVAT-ABLE	TOTAL	WATER LOGGING	SALINITY	WATER SHORTAGE
1	5.0	-	-	5.0	3.0	2.0	5.0	-	-	2.0
2	5.0	-	-	5.0	5.0	0.0	5.0	-	-	0.0
3	6.0	-	-	6.0	1.0	5.0	6.0	-	-	5.0
4	1.5	-	-	1.5	1.5	0.0	1.5	-	-	0.0
5	1.0	-	-	1.0	1.0	0.0	1.0	-	-	0.0
6	2.0	-	-	2.0	2.0	0.0	2.0	-	-	0.0
7	2.5	-	-	2.5	2.5	0.0	2.5	-	-	0.0
8	500.0	-	-	500.0	250.0	250.0	500.0	-	-	250.0
9	3.0	-	-	3.0	3.0	0.0	3.0	-	-	0.0
10	6.0	-	-	6.0	4.0	2.0	6.0	-	-	2.0
11	55.0	-	-	55.0	30.0	25.0	55.0	-	-	25.0
12	2.0	-	-	2.0	1.5	0.5	2.0	-	-	0.5
13	8.0	-	-	8.0	4.0	4.0	8.0	-	-	4.0
14	3.0	-	-	3.0	3.0	0.0	3.0	-	-	0.0
15	4.0	-	-	4.0	4.0	0.0	4.0	-	-	0.0
16	6.0	-	-	6.0	6.0	0.0	6.0	-	-	0.0
17	5.0	-	-	5.0	2.0	3.0	5.0	-	-	3.0
18	7.0	-	-	7.0	4.0	3.0	7.0	-	-	3.0
19	1.0	-	-	1.0	1.0	0.0	1.0	-	-	0.0
20	12.0	-	-	12.0	8.0	4.0	12.0	-	-	4.0
21	7.0	-	-	7.0	4.0	3.0	7.0	-	-	3.0
22	3.0	-	-	3.0	3.0	0.0	3.0	-	-	0.0
23	6.0	-	-	6.0	4.0	2.0	6.0	-	-	2.0
24	14.0	-	-	14.0	7.0	7.0	14.0	-	-	7.0
otal:	665.00	-	-	665.00	354.50	310.50	665.00	0.00	0.00	310.50
Avg:	27.7	0.0	0.0	27.7	14.8	34.5	27.7	0.0	0.0	12.9

Table 3. Respondent use of land under different crops at Qadirabad Site

FARMER NO.	NAME OF RESPONDENT	CULTIVABLE LAND	LAND USE UNDER DIFFERENT CROPS			
			KHARI		RABI	
			RICE	OTHER	WHEAT	FODDER
1	Mr. Ghulam Qadir	-	-	-	-	-
2	Mr. Muhammad Qasim	15.0	15.0	-	10.0	2.0
3	Mr. Akbar Ali Shah	4.0	4.0	-	2.0	2.0
4	Sahibzada Arshad Jamal	8.0		-	8.0	-
5	Mr. Baqir Ali Shah	-	-	-	-	-
6	Syed Akbar Ali Shah	12.0	12.0	-	8.0	2.0
7	Syed Farasat Ali Shah	-	-	-	-	-
8	Mr. Saiful Shah	-	-	-	-	-
9	Mr. Younas Maseeh	20.0	20.0	-	18.0	1.5
10	Ch. Nazir Ahmad Chatta	10.0	10.0	-	8.0	-
11	Mr. Ejaz Hussain Shah	-	-	-	-	-
12	Syed Ghulam Shabbir	-	-	-	-	-
13	Syed Akhlaq Haider	-	-	-	-	-
14	Syed Imdad Ali	-	-	-	-	-
15	Mr. Nisar Ahmad Chatta	5.0	5.0	-	3.0	-
16	Mr. Abdul Razzaq	10.0	8.0	2.0	2.0	2.0
17	Mr. Bashir Ahmad Cheema	3.0	3.0	-	3.0	-
18	Mr. Nazar Ahmad Cheema	-	-	-	-	-
19	Mr. Asmal Ali Shah	1.5	1.5	-	1.5	-
20	Mr. Muhammad Hussain Cheema	-	-	-	-	-
21	Mr. Sajjad Hussain Shah	14.0	14.0	-	7.0	4.0
22	Mr. Muhammad Anwar Shah	-	-	-	-	-
23	Syed Muhammad Hussain	-	-	-	-	-
24	Syed Amanat Ali	10.0	10.0	-	10.0	-
	Total:	112.50	102.5	2.00	80.50	13.50
	Average:	9.38	9.32	2.00	6.71	2.25
	Percentage		91.11	1.78	71.56	12.00

Table 4. Agricultral economics data Qadirabad site

Sr. No.	Crop	No. of Farmers	Cropped Area		Yield			Expenditure			Price	Income			Net Benefit		
			Total	Avg/ Farmer	Total	Avg/ Farmer	Avg/ Acre	Total	Avg/ Farmer	Avg/ Acre	Per Mond	Total	Avg/ Farmer	Avg/ Acre	Total	Avg/ Farmer	Avg/ Acre
1	WHEAT	22	203	9.23	3851.5	175.07	18.97	234550	10661.4	1155.4	130.00	500695.00	22758.9	2466.5	266145	12097.5	1311.1
2	RICE	21	222.25	10.58	5118.3	243.73	23.03	302550	14407.1	1361.3	142.71	730432.60	34782.5	3286.5	427882.6	20375.4	1925.2
3	FODDER	9	24	2.67	16715	1857.22	696.46	21800	2422.2	908.3	11.78	19731.50	2192.39	822.1	-2068.5	-229.8	-86.2
4	OTHERS	3	1.25	0.42	40	13.33	10.67	1600	533.3	1280.0	16.25	650.00	216.67	520.0	-950	-316.7	-760.0

Table 5. Respondent income and expenditure in Qadirabad project area

FARMER NO.	FAMILY SIZE	INCOME AGRI	INCOME OTHER	TOTAL	EXPENDITURE H/H	EXPENDITURE AGRI.	TOTAL	PROFIT	PER CAPITA PROFIT
1	4	19000	0	19000	36000	7500	43500	-24500	-6125
2	11	252250	72000	324250	120000	135000	255000	69250	6295
3	8	85400	18000	103400	36000	41000	77000	26400	3300
4	22	25000	36000	61000	96000	7200	103200	-42200	-1918
5	8	133250	0	133250	60000	72800	132800	450	56
6	10	66400	17000	83400	36000	31000	67000	16400	1640
7	24	100000	0	100000	84000	70000	154000	-54000	-2250
8	16	82000	0	82000	36000	44100	80100	1900	119
9	2	10400	0	10400	7200	45900	53100	-42700	-21350
10	2	58600	0	58600	36000	23600	59600	-1000	-500
11	4	30780	0	30780	18000	12500	30500	280	70
12	37	0	36000	36000	18000	0	18000	18000	486
13	3	40256	36000	76256	60000	21600	81600	-5344	-1781
14	10	15000	27000	42000	19200	6750	25950	16050	1605
15	24	18220	84000	102220	120000	11000	131000	-28780	-1199
16	25	43320	0	43320	96000	16400	112400	-69080	-2763
17	4	10980	0	10980	36000	8400	44400	-33420	-8355
18	9	23557	0	23557	24000	11450	35450	-11893	-1321
19	8	12510	7200	19710	12000	4100	16100	3610	451
20	6	20700	18000	38700	28000	10000	38000	700	117
21	7	79100	0	79100	42000	36900	78900	200	29
22	15	28635	9600	38235	24000	13000	37000	1235	82
23	14	33000	43200	76200	60000	12800	72800	3400	243
24	20	59800	70800	130600	72000	26000	98000	32600	1630
Total:	293	1248158	474800	1722958	1176400	669000	1845400	-122442	-31439.707
Avg:	12.21	52006.58	19783.33	71789.92	49016.67	27875.00	76891.67	-5101.75	-1310

Table 6 Respondent use of land under different at Bara Darush Khela

FARMER NO.	NAME OF RESPONDENT	CULTIVABLE LAND	LAND USE UNDER DIFFERENT CROPS KHARIF				RABI		
			RICE	MAIZE	APPLE	OTHERS	WHEAT	ONION	FODDE
1	Mr. Muhammad Tahir	3	1.5	1.0	0.5	-	1.0	1.0	0.5
2	Mr. Salahuddin	5	3.0	2.0	-	-	2.0	1.0	2.0
3	Mr. Muhammad Nawab	1	1.0	-	-	-	1.0	-	-
4	Mr. Jahanzaib	1.5	1.0	0.5	-	-	0.5	1.0	-
5	Mian Astamoosh	1	1.0	-	-	-	0.5	0.5	-
6	Mr. Muhammad Zubair	2	1.0	1.0	-	-	1.0	1.0	-
7	Mian Syed Jaffar	2.5	1.25	1.25	-	-	1.0	1.25	0.25
8	Mr. M. Afzal Khan	250	-	40.0	200.0	30.0	5.0	-	-
9	Shaheroom	3	1.5	1.5	-	-	1.5	1.5	-
10	Mr. Jalandar Khan	4	2.0	2.0	-	-	2.0	2.0	-
11	Mr. Muhammad Alam Khan	30	-	5.0	25.0	10.0	5.0	-	-
12	Mr. Gulzada	1.5	0.5	1.0	-	-	1.0	0.5	-
13	Mr. Muhammad Nisar	4	-	1.0	3.0	-	1.0	-	-
14	Mr. Ahmad Khan	3	-	1.5	1.5	-	1.5	-	-
15	Khan Nawab	4	2.0	2.0	-	-	2.0	2.0	-
16	Mr. Amal Khan	6	3.0	3.0	-	-	3.0	3.0	-
17	Mr. Gul Muhammad	2	0.5	0.5	-	-	0.5	0.5	-
18	Haji Khan	4	2.0	1.5	0.5	-	1.5	2.0	-
19	Syed Karim Jan	1	0.5	0.5	-	-	1.0	-	-
20	Shahso Tabriz Khan	8	2.0	4.0	2.0	-	2.0	4.0	-
21	Mr. Bab-ud-Din	4	1.0	1.0	2.0	2.0	1.0	1.0	1.0
22	Mr. Gul Rahim	3	1.5	1.5	-	-	3.0	-	-
23	Mr. Arjumand Khan	4	3.0	-	1.0	-	2.0	1.0	-
24	Mr. Gul Omer	7	2.0	4.0	1.0	-	3.0	2.0	1.0
	Total:	354.50	31.25	75.75	236.50	42.00	43.00	25.25	4.75
	Average:	14.77	1.56	3.61	23.65	14.00	1.79	1.49	0.95
	Percentage:		8.82	21.37	66.71	11.85	12.13	7.12	1.34

Table 7. Agricultral economics data Bara Drush Khela site

Sr. NO.	Crop	No. of Farmers	Cropped Area		Yield			Expenditure			Price	Income			Net Benefit		
			Total	Avg/ Farmer	Total Farmer	Avg/ Farmer	Avg/ Acre	Total	Avg/ Farmer	Avg/ Acre	Per Mond	Total	Avg/ Farmer	Avg/ Acre	Total	Avg/ Farmer	Avg/ Acre
1	RICE	20	31.25	1.56	801.50	40.08	25.65	44900	2245.00	1436.80	397.75	318797.00	15939.85	10202	273897.0	13694.9	8764.7
2	MAIZE	21	75.75	3.61	1872.00	89.14	24.71	89100	4242.86	1176.24	123.10	230443.00	10973.48	3042.2	141343.0	6730.6	1865.9
3	APPLE	10	236.50	23.65	14602.50	1460.25	61.74	1.2E+06	118175.00	4996.83	600.00	8761500.00	876150.00	37047	8761500.0	757975.0	32049.7
4	WHEAT	24	88.00	3.67	2155.50	89.81	24.49	126800	5283.33	1440.91	200.00	431100.00	17962.50	4898.9	304300.0	12679.2	3458.0
5	ONION	17	25.25	1.49	5480.00	322.35	217.03	208000	12235.29	8237.62	97.65	535122.00	31477.76	21193	327122.0	19242.5	12955.3
6	FODDER	6	5.25	0.88	361.00	60.17	68.76	4090	681.67	779.05	12.67	4573.90	762.32	871.22	483.9	80.6	92.2
7	OTHERS	2	32.00	16.00	789.00	394.50	24.66	29400	14700.00	918.75	425.00	335325.00	167662.50	10479	305925.0	152962.5	9560.2

Table 8. Respondent income and expenditure in the Bara Drush Khela project area

FARMER NO.	FAMILY SIZE	INCOME AGRI.	INCOME OTHER	TOTAL	EXPENDITURE AGRI.	EXPENDITURE H/H	TOTAL	PROFIT	PER CAPITA PROFIT
1	12	47860	24000	71860	17700	48000	65700	6160	513.33
2	15	73860	24000	97860	17600	78000	95600	2260	150.67
3	5	16000	48000	64000	2800	48000	50800	13200	2640.00
4	9	39875	0	39875	9700	36000	45700	-5825	-647.22
5	16	26900	6000	32900	5950	36000	41950	-9050	-565.63
6	19	40700	18000	58700	13200	42000	55200	3500	184.21
7	14	60800	0	60800	14940	48000	62940	-2140	-152.86
8	8	7776000	0	7776000	1151000	900000	2051000	5725000	715625.00
9	16	55200	0	55200	18150	36000	54150	1050	65.63
10	16	72400	0	72400	20200	48000	68200	4200	262.50
11	11	1695200	0	1695200	144000	600000	744000	951200	86472.73
12	13	25460	12000	37460	7950	30000	37950	-490	-37.69
13	16	131200	0	131200	17400	96000	113400	17800	1112.50
14	30	84900	140000	224900	9750	192000	201750	23150	771.67
15	10	70080	0	70080	24000	43200	67200	2880	288.00
16	16	106950	0	106950	41700	54000	95700	11250	703.13
17	9	20800	36000	56800	6950	48000	54950	1850	205.56
18	21	88500	0	88500	23550	60000	83550	4950	235.71
19	7	9650	30000	39650	2550	30000	32550	7100	1014.29
20	10	170400	0	170400	54600	96000	150600	19800	1980.00
21	7	121315	12000	133315	24200	72000	96200	37115	5302.14
22	11	35520	12000	47520	8100	36000	44100	3420	310.91
23	13	94200	0	94200	21800	66000	87800	6400	492.31
24	21	130700	24000	154700	36500	96000	132500	22200	1057.14
Total:	325	10994470.00	386000.00	11380470.00	1694290.00	2839200.00	4533490.00	6846980.00	817984.02
Avg:	13.54	458102.92	16083.33	474186.25	70595.42	118300.00	188895.42	285290.83	34082.67

Table 9. Respondent use of irrigation source and irrigation methods in Qadirabad project area

FARMER NO.	IRRIGATION SOURCE					IRRIGATION METHOD		
	CULTIVATABLE LAND	MINOR		TUBEWELL		BASIN	FURROW	WILD FLODDING
		KHARIF	RABI	KHARIF	RABBI			
1	-	-	-	-	-	-	-	-
2	15.0	5.0	-	15.0	12.0	-	-	15.0
3	4.0	4.0	-	4.0	4.0	4.0	-	-
4	8.0	-	-	-	8.0	8.0	-	-
5	-	-	-	-	-	-	-	-
6	12.0	10.0	-	12.0	10.0	10.0	-	12.0
7	-	-	-	-	-	-	-	-
8	-	-	-	-	-	-	-	-
9	20.0	-	-	20.0	19.5	20.0	-	-
10	10.0	5.0	-	10.0	8.0	8.0	-	10.0
11	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-
13	-	-	-	-	-	-	-	-
14	-	-	-	-	-	-	-	-
15	5.0	-	-	5.0	3.0	-	-	5.0
16	10.0	-	-	10.0	4.0	-	-	10.0
17	3.0	-	-	3.0	3.0	-	-	3.0
18	-	-	-	-	-	-	-	-
19	1.50	-	-	1.50	1.50	1.50	-	1.50
20	-	-	-	-	-	-	-	-
21	14.0	-	-	14.0	11.0	14.0	-	14.0
22	-	-	-	-	-	-	-	-
23	-	-	-	-	-	-	-	-
24	10.0	10.0	-	10.0	10.0	10.0	-	10.0
TOTAL:-	112.50	34.00	0.00	104.50	94.00	75.50	0.00	80.50
AVG:-	9.4	6.80	0.00	9.50	7.83	9.44	0.00	8.94
PERCENTAGE	-	30.22	0.00	92.89	83.56	67.11	0.00	71.56

Table 10 Respondent use of irrigation source and irrigation methods in Bara Drush Khela

FARMER NO.	CULTIVATABLE LAND	IRRIGATION PATTERN		IRRIGATION METHOD		
	(ACER)	DIVERSION CHANNEL	BARANI	BASIN	FURROW	WILD FLOODING
1	3	3	-	2.5	0.5	-
2	5	3	2	5	-	-
3	1	1	-	1	-	-
4	1.5	1.5	-	1.5	-	-
5	1	1	-	1	-	-
6	2	2	-	2	-	-
7	2.5	2.5	-	2.5	-	-
8	250	240	10	50	200	-
9	3	3	-	3	-	-
10	4	4	-	4	-	-
11	30	25	5	5	-	25
12	1.5	1.5	-	1.5	-	-
13	4	3	-	1	3	-
14	3	1.5	1.5	1.5	1.5	-
15	4	4	-	4	-	-
16	6	3	3	6	-	-
17	2	1	1	2	-	-
18	4	4	-	3.5	0.5	-
19	1	1	-	1	-	-
20	8	4	4	6	2	-
21	4	4	-	2	-	2
22	3	3	-	3	-	-
23	4	4	-	3	1	-
24	7	3	4	6	1	-
Total:	354.50	323.00	30.50	118.00	209.50	27.00
Avg:	14.77	13.46	3.81	4.92	26.19	13.50
Percentage	-	91.11	8.60	33.29	59.10	7.62

Table 11. Farmers perception about WUA's and their role in Qadirabad project area

FARMER NO	MEMBER OF ANY ORGANIZED GROUP YES/NO 1/0	RELATED DISPUTES IN LAST 2 SEASONS YES/NO 1/0	CONFLICT RESOLVING MECHANISM: MUTAL AGREEMENT	CONFLICT RESOLVING MECHANISM: INTERVENTION OF FAMILY MEMBERS	CONFLICT RESOLVING MECHANISM: INTERVENTION OF INFLUENTIAL INDIVIDUAL	CONFLICT RESOLVING MECHANISM: INVOLVEMENT OF GOVT FUNCTIONS	CONFLICT RESOLVING MECHANISM: PUNCHAYAT	WILLINGNESS TO FORM WUA YES/NO 1/0	WILLINGNESS TO COOPERATE PHYSICALLY IN TECHNICAL INTERVENTION: SHARING THE COST SUBSTANTIALLY	SHARING THE COST MARGINALLY TIALLY	COST SHARIGN SUBJECT TO CONDITIONS	ONLY THROUGH: LABOUR	ONLY THROUGH: MATERIAL	HIS CONTRIBUTION DEPENDS UPOND POLITCAL DECISION	ROLE PERCEIVED BY THE USER IN ASSOCIATION: BEING THE COMMITTEE MEMBER	ORDINARY MEMBER	HELPING THE AGENCY PERSONNEL	ANY OTHER
1	0	0	0	0	0	0	0	1	0	0	0	1	1	0	0	1	0	0
2	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
3	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	1	0
4	0	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0	0
5	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0
6	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
7	0	0	0	0	0	0	0	1	0	0	0	1	1	1	1	0	0	0
8	0	1	0	0	0	0	0	1	0	0	0	1	0	0	0	1	0	0
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	1	0	0	1	1	0	0	0	1	0	0
11	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
12	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
13	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
14	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
15	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	1	0
16	0	1	1	1	0	1	0	1	0	0	0	1	0	0	1	0	0	0
17	1	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
18	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
20	1	0	0	0	0	0	0	1	0	0	0	0	0	1	0	0	1	0
21	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
22	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
23	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
24	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
TOTAL	2	2	1	1	0	1	0	22	0	0	13	7	3	3	10	12	3	0
PERCENTAGE	8	8	100	100	0	100	0	92			54	25	11	11	40	48	12	0

Table 12. Farmers perception about WUA's and their role in Drush Khela project area.

FARMER NO	MEMBER ANY ORGANIZE GROUP YES/NO 1/0	RELATED DISPUTES IN LAST 2 SEASONS YES/NO 1/0	CONFLICT RESOLVING MECHANISM: MUTAL AGREEME	INTERVENTION OF FAMILY MEMBERS	INTERVENTION OF INFLUENTIAL INDIVIDUAL	INVOLVEMENT OF GOVT FUNCTIONS	PUNCHAYAT	WILLINGNESS TO FORM WUA YES/NO 1/0	WILLINGNESS TO COOPERATE PHYSICALLY IN TECHNICAL INTERVENTION: SHARING THE COST SUBSTAN-TIALLY	SHARING THE COST MARGINALLY TIALLY	COST SHARIG SUBJECT TO CONDITIONS	ONLY THROUGH: LABOUR	MATERIAL	HIS CONTRI-BUTION DEPENDI UPONO POUTCAL DECISION	ROLE PERCEIVED BY THE USER IN ASSOCIATION: BEING THE COMMITTE MEMBER	ORDINARY MEMBER	HELPING THE AGENCY PERSONNEL	ANY OTHER
1	0	1	0	0	0	1	0	1	1	0	0	0	0	0	0	1	0	0
2	0	1	0	0	0	1	0	1	1	0	0	0	0	1	0	1	0	0
3	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
4	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
5	0	1	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0	0
6	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
7	0	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
8	0	1	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
9	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
10	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
11	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
12	0	1	1	1	0	0	0	1	1	0	0	0	0	0	1	0	0	0
13	0	1	1	1	0	0	0	1	0	0	1	0	0	0	0	0	1	0
14	0	0	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0	0
15	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	1	0	0
16	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0	0	1	0
17	0	1	1	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
18	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
19	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
20	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
21	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
22	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0
23	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	1	0	0
24	1	0	1	1	0	0	0	1	0	0	1	0	0	0	1	0	0	0
25	1	0	0	0	0	0	0	1	1	0	0	0	0	0	1	0	0	0
PERCENTAGE	4	[illegible]	50.00	25.00	[illegible]	25.00	[illegible]	100.00	58.00	4.00	20.00	4.00	0.00	4.00	30.43	52.17	17.39	0.00

REPORT ON

ACTION RESEARCH PLAN

OF

ENCOURAGING WATER USERS

ASSOCIATION

AT

QADIRABAD

AND

SWAT

PART - II

Action Research Plan of Encouraging Water Users Association at Qadirabad and Swat

Munir A Bhatti, Zahid Masood Ahmad, and Zafar Iqbal Khan[1/]

1) Introduction:

Irrigation is a socio-technical process combining people with technology and material things. Water is a scarce resource and it is to be used collectively by the end users. Since it has to be used by many farmers, it has to be managed by a person or a group or groups or an agency or a group of agencies. The management activities occur at various levels i.e. (1) upper level which consists of operation of reservoir, main canals and sub-canals, (2) middle level which consists of operation of distributaries minors, and (3) lower level which takes care of the operation of watercourse and farm ditches. Various irrigation systems have different levels of management. Here we are concerned with the lower level system which consist of either watercourse and field ditches or water source and field ditches. This management activity can be performed by an agency or by the farmers group or a combination of both.

In this study, the efforts were concentrated to look at the mechanism of farmers cooperation for water management. Farmers groups can be organized by the farmers themselves or can be formed by the intervention of agency personnels. Most of the efforts in the past has been concentrated on motivating the farmers to form and operate water users association by providing them materials to line a part of their watercourse. So the farmer do have the experience of forming and operating a WUA for lining their common watercourse. The farmers cooperation for organizing drainage activities has not been reported in the literature. In general a water users association exists to attain the general goal of better water management. As reported in the pre-project report two sites were selected to carry out the action research programme. One, at Qadirabad where the response of the farmers was to be studied for better water management through the introduction of a package of technology which primarily consisted of tile drainage, watercourse lining and reuse of drainage water. Two, at Bara Drush Khela in Swat where the package of technology was the construction of diversion structure and lining of the diversion channel. During the implementation stage due to the difficulties of high flow in River Swat and shortage of funds, the Swat site was shifted to Shah Dheri site in Swat and another site at Bara Drush Khela was introduced for looking at the impact of high efficiency irrigation system. In all the sites the intervention of normal government functionaries were minimal as at all the sites the water resource was to be developed and managed by the farmers themselves.

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2) Approaches to Organize Farmers.

There are two approaches to organize the farmers for better water management. Water user organization can emerge from within and from outside. From within means that societal structure makes the individuals obligatory to organize themselves to meet a collective task for the betterment of community. From outside means that organization are formed by the motivation of the Government or NGOS functionare to start a project for community betterment. In this type of organization most of the individuals do not foresee the benefits of the technical interventions, therefore the developing agency has to educate the locals about the benefits if they behave collectively.

3) Quantification of Benefits to Farmers:

Farmers cooperate among themselves if they see benefits in collective efforts. If a person can harvest more benefits by doing a solo flight, he would not in general cooperate with others though there do exist many social pressures which force him to cooperate. Water users associations are formed to attain the general goal of better water management.

This goal of better water management can be translated according to the following objectives:

1)	Increase in crop production per acre	(Y)
2)	Increase in area cultivated	(A)
3)	Increase in cropping intensity	(I)
4)	Improved water distribution	(W.D)
5)	Reduction in conflicts	(RC)
6)	Greater resource mobilization	(GRM)
7)	Sustained system performance	(SSP)

The total benefits from an organization having n number of farmers can be presented as:

$$T.B = X_1\ Y + X_2\ A + X_3\ I + X_4\ W.D + X_5\ RC + X_6\ GRM + X_7\ SSP$$

$X_1 \ldots\ldots X_7$ are weights which can be assigned by the decision makers.

The detail of Y, A, I, W.D, RC, GRM and SSP are given above.

The above mentioned objectives are self-explanatory and can be achieved if the water is managed properly by the water users association through a set of activities. The constraints in the system can come from how the following activities are performed. The set of activities are:

a) Activities focusing on reliability with respect to quantity, quality and timing. These activities can be translated as:

$Q_{1t} >/ D_{1t}$

$Q_{nt} >/ D_{nt}$ Where P is the number of Irrigations required during the year.

$Q_{1t} >/ WQUAL$

$Q_{nt} >/ WQUAL$

$t = 1$ to P

$Q_{nt} >/ D_{nt}$

where P is the number of irrigations required during the year.

b) Activities focusing on the structure to obtain necessary amount of water in time and space.

These activities consist of construction, improvement and maintenance of reservoirs, ponds, distribution channels, water course and field ditches. The following can be put as constraints:

$$TWA_t >/ TWR_t$$

$$TWA_t = Q_{1t} + Q_{2t} + \ldots\ldots\ldots Q_{nt}$$

$$TWR = WR_{1t} + WR_{2t} + \ldots\ldots\ldots WR_{nt}$$

where

TWA_t = Total water availability at time A for n farmers

TWR_t = Total water required at time t for n farmers

c) Activities focusing on the organization.

These activities consist of farmers cooperating among themselves for carrying out the tasks mentioned in (2). If any farmer is not cooperating, then he will be out of the total increase in the parameters mentioned at (1) by a certain factor. The essential elements of the organization are:

1) Decision making and planning

2) Resource mobilization management

3) Communication and coordinating among farmers and with Govt. agencies

4) Conflict management.

These elements are represented in the objective function and in the constraints also. Putting them in the model needs complete understanding of socio-economics and technical parameters and variables of the system. They are inter-related and inter-connected. The basic idea of having this model is that if water user associations are functioning properly, then the benefits must be quantifiable.

4) Pre-Project Report for Shah Dheri Site:

The pre-project socio-economic study data for Qadirabad Drush Khela site has been presented in the earlier report. Earlier Bara Drush Khela located along the river Swat was selected for the action research. Pre-project socio-economic data of the Bara Drush Khela was collected and analysed. At the time of project intervention i.e. construction of diversion at river Swat and water channel from that diversion, it was realized that due to the high flows in river Swat, the water was moving at a high velocity. To start the work of diversion construction was at least next to impossible. The second project intervention i.e. using spring water for irrigation through sprinkler, due to non-availability of sprinklers was also delayed at Bara Drush Khela. Therefore, authorities at PCRWR decided to change the site from Bara Drush Khela to Shah Dheri for the project intervention of diversion construction. In Shah Dehri Site, Swat, 83 Farmers acquiring water for irrigation from the diversion channel from Shah Dehri Khowr were interviewed. All reside in the Shah Dehri village. For Shah Dher site at Swat the material and their analysis is presented here.

4.1 Action Research

Technical, social, economic and organizational indicators are established to evaluate system performance. The system was equipped with and irrigation infrastructure in the case of Shah Dehri. Water Users Associations were formed in the area. These organizations are prerequisites to the proposed action research program since the users shared around 40% to 50% of the capital cost of the project and have to bear the subsequent costs of operating and maintaining the physical systems.

In the project implementation phase, in which the water users and the other sections of the village community were involved in collaboration with relevant government agencies, the following technologies were introduced:

- Construction of lined water course at Shah Dehri site
- Construction of appropriate diversion structures at project site on Shah Dehri Khower
- Formation of WUA at Shah Dehri

- Development and introduction of appropriate new water management and crop rotation systems for optimum production at site.

After these technologies were introduced, mechanisms to use them have been demonstrated for the first three technologies. The importance of the end user's participation in the activities were and are being emphasized. After the technology intervention, the following were and are being monitored, where applicable:

1) operation of the water distribution system

2) maintenance of channels and watercourses

3) crop rotation system and crop production

4) organizational behavior patterns and decision-making processes

5) socio-economic changes with respect to technology intervention.

Since the maintenance of the systems has to be carried out by the users themselves, their participation in the process as a whole was closely monitored. It helped us to gain intimate knowledge of the issue and constraints of organized behavior at the farm level, and of group decision-making processes.

Post-project monitoring was conducted to identify the problems and appropriate solutions for organizing Water Users Associations in relation to the interventions during project implementation though in the end we were able to gather only the prelimnary data for the post analysis.

4.2 Material Presentation and Analysis:

4.2.1 Education:

At Shah Dehri Site (Swat), the literacy rate is very poor. The data regarding education is presented as under:

1.	No Education	70
2.	Primary	4
3.	Middle	1
4.	Secondary	3
5.	Higher Secondary & above	5
	Total:-	83

At Shah Dehri site the average literacy rate is very low even it is lower then the Bara Drush Khela site.

The average educational standard is not encouraging but a few highly educated persons are very helpful in introducing the technical intervention in the area as they are from the area and belong to a dominant (both population and power vise) group and people of the area have trust on them.

4.2.2 Family Pattern:

In Shah Dehri site both joint and nuclear family pattern is being practice. However, joint family pattern is still stronger as out of 83 families 48 families have joint family structure and 35 families are practicing nuclear family system. Maximum size of joint family is 27. The minimum size of joint family is 6 the average size of a joint family is 12.15. The maximum size of nuclear is 12 and minimum size of nuclear family is 4. The average nuclear family size is 7.77.

The data shows that the nuclear family pattern is being created even in the far flung and comparatively remote areas. However, size of both type of family [illegible] very large and have burden on the limited local resources.

4.2.3 Cas[illegible] System:

In Shah Dehri majority of the respondents belong to sub-tribes/clan of Yousafzai tribe of Patthans. Tribe viz division of 83 respondents is as under:

Patthan Yousafzai	66
Patthan Khatak	1
Gujjar	11
Paracha	4
Swati	1
Total	83

During the field survey it was observed that Lynch's (88) suggestion about homogeneity of the water users is quite relevant in the Shah Dehri site (Swat).

4.2.4 Land Holding and Land Use:

In Shah Dehri 83 respondents reported having total 127.56 acres land with an average of 1.54 acres per respondent family. Table 2(A) shows the size of land holding of each respondent. All the land is under cultivation. 118.81 acre land is irrigated cultivated whereas 8.75 acres is un-irrigation cultivated (rain-fed) land. The largest land holding of 83 respondents is 50 Kanal (6.25 acres) and the smallest land holding

is 1.5 Kanal (0.19 acre). It is evident from the figures that land holding in Shah Dehri is very small as compared to Bara Drush Khela, and Qadirabad research sites. Thus the land resources in Shah Dehri have severe population pressure.

Distribution of Cultivable Land

1 to 10 K	43
11 to 20 K	29
21 to 30 K	8
31 to 40 K	1
41 to 50 K	2

4.2.5 Crop Production:

At Shah Dehri site almost all possible cultivable land is under cultivation of both Rabi and Kharif crops. During the field survey Rabi crop season was on and Wheat, Onion and Fodder were grown in the field. Area under these crops is given in Table 6-A. During informal discussions all farmers mentioned that in Kharif season Maize is the only crop of the area which they grow in all cultivable land.

Table 7-A shows the average cultivable land holding size, yield of crop per acre, total cost of agricultural activities, total income from agricultural output profit of individual farmers and the average income per acre.

4.2.6 Irrigation:

Shah Dehri Khor (Stream) is the main source of irrigation. A diversion bund (check dam) exists on the stream to divert water for irrigation at a height of 4000 feet above sea level. The structure is temporary and is constructed again and again by the farmers on self help basis. A conveyance channel has been erected by the farmers to carry the water to the fields. The channel crosses twelve stream irrigation. The channel flows throughout the year but its discharge changes with time. Many distributaries off take from the channel to irrigate the farms. All the beneficiaries of the water course provide labor and finances for the repair and maintenance work. Irrigation is done for both Kharif and Rabi season; 83 out of 84 farmers receive water from the channel. The water allocation is related to the amount of water in the Shah Dehri stream which varies between wet and dry seasons of the year. The supply of water also varies in the channel during the cropping seasons and crucial water demand period i.e. in the months of June and July when it is needed more for Onion and Wheat crop.

4.2.7 Method of Irrigation

In Shah Dehri site, all the respondents use the furrow method for irrigation irrespective of the crops. Only few farmers, because of the vicinity to the upper reach of the channel, use the basin irrigation for wheat, maize and fodder crop.

4.2.8 Decision Making and Cooperation Mechanism:

In Shah Dheri site at Swat, 83 farmers were interviewed and all of them were member of the traditional Jirga organization. As reported by them, the responsibility of water resources development and management has been vested entirely to the farmers and land owner of the area. This task was and is being done by the farmers on communal basis. This cooperation among the farmers has history which dates back to the arrival of Yousaf Zai tribe in the area. As in other parts of Swat, an informal association of the irrigators exist in the area where the share and timing of each shareholder is decided for taking out water from the common diversion channel. The leader of this informal organization is from the dominant family of Yousaf Zai. For cleaning and maintenance activities on the channel which is done twice a year, the leader assigns the duties in a shareholders meeting or unilaterally. He also assigns the dates for the reconstruction of the channel after flash floods and who should do it. The conflicts among the water users usually occur due to water allocation, time scheduling, water theft and for lack of interest in maintenance. Sixteen water related conflicts were reported in the area in year 1989. The conflicts were generally resolved by the Jirga System.

All the 83 farmers were willing to form the formal water users association and their intended cooperation can be seen in the following.

S.No.	Cooperation Mechanism	No. of Farmers
1.	Sharing the cost	0
2.	Sharing the cost marginally	83
3.	Cost sharing subject to the conditions	0
4.	Only through labor	3
5.	Only through material	0
6.	Contribute depending upon political decision.	0

All the farmers wanted to play some role in organizing the water users association. The role as envisaged by them is given as under:

S.No.	Role	No. of Farmers
1.	Being committee member	17
2.	Being ordinary member	56
3.	Helping the agency personnels	10

Belonging to the traditional tribal system, it was easy to convince farmers to organize. The farmers at Shah Dheri realize the benefits from cooperation as the water development and maintenance is done by them and the decision are made locally.

5) Bara Drush Khela Pond Site (SITE II):

One of the major water resource in the intermountainous areas of Swat is spring water. A site in Swat was to be selected with the following criteria:

1. Willingness of the water users to apply the high efficiency irrigation techniques.

2. Sharing the capital cost.

3. Willingness of the water users to maintain the system at their own.

4. Willingness of water users to let PCRWR monitor the socio-economo-technical parameters of the area and the techniques.

A site near the Bara Drush-Khela was selected for this purpose. A spring exist at almost 276 ft above the irrigation site and is owned privately by the water user. This gives us freedom to design and operate the system.

5.1 Material Presentation and Analysis:

The total irrigated area of the site is around 1.2 acres. The total land is owned by a predominant political family. There are four male members of the family. They live in a joint family system. The father and his three sons. All four of them are educated. They belong to the Yusaf Zai tribe of the Pathan. Mostly the decision are made by the head of the family which is father in this case. All the land in the valley is cultivated by the farmers and by their tenants. There is no reliable irrigation source in the area. The water is available from the diversion channel of Bara Drush Khela and from the rainfall. The

spring source has not been developed though the water user has constructed a water tank at almost 271.50 ft high. Wheat and Orchard are the crops of the area. Wheat is also sown as interculture crop.

5.2 Project Intervention:

PCRWR planned to install the high efficiency irrigation system in the form of low head sprinkler system in the area keeping in view that water source at considerable height is available and is privately owned by the farmer. The farmer is willing to install the system on the site. He is also willing to help PCRWR to study the socio-economic and technical parameter of the area.

5.3 Status and Experience of PCRWR:

The area has been surveyed with respect to crop, levels of water source and possible water conveyance route. The low-head sprinkler system has been designed and some of the materials have been purchased. The installation process is in progress.

It can be easily concluded that progressive farmers can be the catalytic agent for technology intervention. For better water management. These farmers are receptive to new ideas and are willing to apply the new technology to the extent that they want to share the cost substantially.

6. Experience at Shah Dehri Site:

6.1 Project Intervention

As mentioned in the pre-project report that most of the farmers could not manage the water optimally because of water losses in the channel due to seepage, leakage and siltation. Therefore, the technical interventions done in the area were:

1) Lining of diversion channel for approximately 380 meters.

2) Building of an appropriate Gabion diversion structure.

This package of technology was introduced with the help of water users associations of the area. As mentioned earlier, the WUA was formed to construct and manage the diversion structure and the diversion channel. The WUA provided the labour for carrying out the work of construction of Gabion diversion structure & lining of the diversion channel. The WUA was made responsible to distribute the water among the farmers.

During and after the technical interventions, the response of the farmers were studied.

6.2 Project Knowledge and Willingness to Participate:

All 83 respondents were well aware of the project. To them it was a good intervention which had increased the water quantity for irrigation. As they saw and perceived good amount of benefits they had therefore participated in the project implementation.

6.3 Option for Participation:

Responses of the 83 respondents for option given to farmers to participate in the project area are as under:

1) Sharing the cost substantially

2. Sharing the cost marginally

3) Cost sharing subject to condition

4) Only through labor

5) Only through material

6) Contribution depending upon political decision.

Thirty respondent agreed for options 2 and 4, sharing the cost marginally and through labor respectively. Forty-five respondents agreed for option 4 only. One respondent agreed for option one only and one respondent agreed for option 1 to 5. This farmer has his land on the watercourse but his land in the past was classified as barani land, hence was not allowed water from the waterCourse. Therefore, he agreed to accept any option if he is allowed to use the water from watercourse. Further to his land are the lands of village Khan who in the past, at his own expense had derived the watercourse which passes through the lands of this farmer. As Khan had shouldered the expenditure for the watercourse excavation, therefore, he did not allow him the water. The six respondents' response was nil. Most of the farmers were active in the technical intervention as they indicated in the pre-project survey. During the technical intervention, various meetings of the WUA were held and the mode of participation was dicussed in detail. The President and the General Secretary of the WUA were made responsible for assigning of the duties to various farmers. Some farmers provided funds to hire labour on their behalf. Generally the farmers of the area behaved enthusiastically as a group for making the work a success.

6.4 Post Project Data and Analysis:

In the post project stage, the indicators for change of organized group behaviour were grouped into the following:

1) Increase in water availability and operation of water distribution system
2) Maintenance of diversion bund and diversion channel.
3) Crop production, crop rotation and cropping intensity.
4) Organized behaviour pattern and decision making pattern.
5) Socio-economic changes in the society.

The data on all these five groups could not be collected in just two months after the technology intervention. Encouraging Water Users Assocation-Action Research Project will continue and the Research Team of the Council will monitor the project in next two year. However, some preliminary data was collected and is presented below:

6.4.1 Operation of Water Distribution:

A well accepted water distribution system existed prior to the technical intervention. After the intervention, as reported by the water usrs, the delivered amount of water on the previously allocated time has increased upto fifty percent. It is also reported that farms which were irrigated previously in one day are now being irrigated in half time. Farmers are now planning to reschedule the water allocation system. Farmers perception about the increase in water quantity is shown as:

Sr. No.	Increase in Percent	No. of Respondent
1.	No Increase	2
2.	1 to 25%	Nil
3.	26 to 50%	70
4.	51 to 75%	7
5.	76 to 100%	4
	Total:-	83
	Average Increase is	51.02%

Six farmers still see shortage of irrigation water for their crops. Five farmers have uncultivated land and they think that the increase in water delivery will help them in bringing that land under cultivation.

Generally, it can be deduced that the total amount of water has increased in the project area and most of the farmers agree with it. Though the exact amount of increase is still not quantified, the increase can be estimated from the response of the farmers and from the decrease in time for irrigation. The increase in the total available amount of water has reduced the conflicts in the area.

Farmers/respondents were asked about the expected benefits from the increase of water and about the technology intervention. They were asked about the seven parameters;

1. Increase in Delivery
2. Seepage losses minimize
3. Pakka muga/naka
4. Easy irrigation
5. Easy cleaning
6. Easy maintenance
7. Utilization of un-cultivated land

Sr.No.	Benefit	Respondent
1.	1-6	78
2.	1-7	4
3.	Nil	1
Total:		83

Seventy-eight out of 83 respondents saw that the technology intervention has benefited them on aspects mentioned from 1 to 6 whereas four farmers saw the benefits as mentioned above from 1 to 7 have been achieved. One farmer saw no benefits from the technical intervention as he did not receive any water from the channel. However, during a discussion, he was of the view that the whole community has been achieving the desired benefits.

6.4.2 Maintenance of Channel and Diversion Bund:

The diversion structure and the diversion channel in the area has been maintained traditionally on a communal basis. The Jirga has been assigning duties to individual farmers for their share in maintaining the hydraulic structures. The formation of the water user association has streamlined the process, and has now

made it more formal. Since the farmers have gone through the experience of collectively constructing the structure and the process went smoothly as conceived, they now are cooperating with each other with more zeal and vigour.

6.4.3 Cropping Pattern and Crop Production:

The individual farmers are of the opinion that due to increase in water delivery there are chances of increased crop production.

When asked after the technical intervention when water delivery upto their land has increased, whether they were going to change the cropping pattern, the response of 16 farmers were positive whereas 66 water users have not considered about this option. According to them the area is best suited for the crops already grown. However they see that with the increase in water delivery at farm level, the yield per kanal would be more and better. One farmer who is not benefitted from watercourse gave no response to the question. Over all there has been no significant change in the cropping pattern. The shift in cropping pattern from wheat to onion can be attributed to the market prices and the increase in water. The real response from the increase of water has yet to be seen.

6.4.4 Organizational Behavior Pattern and Decision Making Pattern:

The society, was in practice, within community organization pattern (informal) for water management. However, during the intervention it has formaly organized itself into a water user association without any opposition. All the 83 respondent at Shah Dehri agreed that the village Jirga is the only institution which has the decision making power on different communal socio-economic matters. Few decades ago, Swat was a Kingdom which had its control over the area through Khans of different villages. These Khans were in possession of most of the village lands and they were considered as the Chief of the village. Since few decades ago, the kingdom of the Swat was abolished. But these Khans remained the Chief/Leader of the society as they were holding major portion of village resources. They have say in irrigation water allocation timing. They still hold a respectable leadership rule and have say in community socio-political affairs. In Shah Dehri a few educated people who are also relatives to these Khans are able to understand the project intervention. They convinced the Khan that the technical intervention is in his best interest and made him agree to support the

programme. It is revealed that the education, kin relation and sense to share the benefit of technical intervention instigated the leadership at Shah Dehri to favour and support the project.

Farmers/respondents were asked that after technical intervention which of the following expected benefits from water course and Gabion diversion construction and from WUA formation have been achieved with the help of the formation of water users association:

1. Better maintenance management of irrigation system

2. Increase in mutual cooperation

3. Better efficiency of irrigation in time and space

4. Decrease in time consumption

5. Better dealing with Government officials.

Eighty-two respondents see benefit listed 1 to 5 are being achieved through the formulation of WUA. One respondent replied nothing but he was of the opinion that all listed benefit could be achieved.

6.4.5 Socio-Economic Changes with Respect to Technology Intervention:

As the technological interventions have taken place only in recent past, a visible socio-economic change has not been observed yet. However, after a crop season these changes (if any) will be monitored.

Discussion:

At Shah Dehri Site in Swat the technical intervention, such as water course construction gabion bund construction at hilly stream and the formation of water users association, under action research of Encouraging Water Users Programme (EWU) is an excellent example of applied nature of anthropological work wherein both physical development and community organization tasks are inter connected with each other and taking place side by side.

In Shah Dehri the formulation of WUA was a pre-requisite for the physical intervention though the community has the informal traditional tribal system of organization. In the formal organization, office bearers are not from the elite (Khan) class who had been and are still holding the top position in the community. But it does not mean that the Khan of the village has been neglected in this important task. In fact the office bearers of the WUA have full support and backing from

both general class and Khan family. However, these office bearers are from the major ethnic group of Yousafzai tribe. It has been observed that there was no constraint in the formation of WUA here because of the help of all the classes of the society in the area.

In the recent past the association was busy in the construction of water channel and gabion dam structures at Shah Dheri Khawer to secure more water delivery in the channel, resulting in more irrigation water at the farm level. For the physical development work, the WUA established a mechanism collectively to provide labor or labor charges according to their share in the water. With the increase in water delivery in the watercourse, the WUA is planning to re-schedule the water delivery at the farm level.

As the informal organization of water users is functioning successfully since long and this formal water user association have gone through the experience of the physical intervention, there are bright chances that WUA at the Shah Dheri will be a viable association for the maintenance of the hydraulic structures for the general goal of better water management.

7. Experience at Qadirabad Site:

The site selected for this study as reported in pre-project report was Block-6 of the Qadirabad Tile Drainage Project. In Qadirabad site, as is the case in the whole of Punjab, the decision power is in general with the feudal lords. They are big land owners and have avoided or manipulated the land reform by distributing land among their family members. In rural Punjab, they are still the masters of the people. They do not make decisions with the cooperation of farmers but dictate their decisions. Their decisions are mostly vetted by government functionaries because of their political influences. Our experience in the area is presented as follows:

7.1 Formulation of Water Users Association:

The most important objective of forming water users associations in the area was to promote community participation for better water management though installation of the drainage and lining of water courses. Efforts for organizing the farmer began in late 1991. Various formal & informal meetings were held with the farmers. Farmer were told of the benefits of the technology package and were informed about the mode of operation. The farmers were told that this technical intervention has been worked out on the concept that the end users will share a part of the cost based on the DRIP model which is being practiced in Sindh for the installation of tile drainage project. Information was sought regarding existing organized behaviour at the Qadirabad research site. This information helped us by providing data to

look into the mechanism of the formation of water users association. In the initial meetings, except for a few very poor farmers, almost all farmers agreed to share the cost of the project by contributing funds via water users association. However when the matter reached the local political leaders, the whole scenario changed. They strictly opposed the idea of cost sharing by the farmers through water users association. The local leaders had some contacts at the minister level. Due to their contacts and with the assistance of higher ups, they demanded that the total work of development & operation be done from government funds. They stopped the farmers community to participate in the project through cost sharing. Due to this role of local political leaders the long motivational efforts made by the EWU and DRIP teams, which seemed to be successful in the initial stages, became unsuccesful.

7.2 Collaborative Programme of Technology Intervention:

The PCRWR initiated lined watercourses construction project under the EWU Action research programme. The project was interlinked with the DRIP's tile drainage project. Beside the minor canal and tubewell water, the effluent of the drainage was to be re-used in the farms by the farmers themselves through the lined watercourses. The farmers were to pay 30 to 50 percent of material cost and to provide labor for watercourse lining. Upon completion of the project WUA were to operate & maintain the whole system themselves. But due to the same socio-political reasons, the tile drainage project could not be undertaken. Therefore the inter-linked project of lining watercourse was also delayed. But the activity of lining of water course was done, keeping in view the tile drainage project. The watercourses at three sites in Qadirabad research site were constructed and lined as the farmers of those areas took keen interest and were ready to share the cost.

As described earlier, the main objective of the study was to form a water user association which should function during the planning, operation & maintenance of the water use, water reuse and water disposal components of the project. The idea behind this approach was that farmers will have more decision making powers to manage the system. This decision making power will provide catalyst for the cooperation among farmer for better water management. This study was supposed to look in detail into the process.

7.3 Change in Package of Technology & Technology Intervention:

Since the farmers of the area were unhappy about the delay in the project and about the decision being forced by PCRWR to share the cost, PCRWR could not introduce the package of technology as planned. Therefore, to get the confidence of the farmers back, a site outside the project was selected because the farmers of that area were willing to form the organization and share the cost. The site selected was Sultanpura. The farmers were organized and each of them was ready to provide labor to implement the collective effort of lining the water course. It has been observed by the PCRWR staff that the farmers from the tail reaches were more instrumental in organizing the farmers and were active in implementing the project.

The willingness of the farmers at Sultanpura and the seriousness of PCRWR at the collective activity could spread the news in the area and the farmers started to realize the benefits of technical interventions in collective work. Farmers of the area approached the PCRWR staff to implement the project in the original site. Two sites were selected in the area; one, where water sources were from tubewell and drainage effluents; two, where water sources were from irrigation minor, tubewell and drainage effluents. Since the drainage project was not completed, the benefits from the reuse of water could not be measured. The detail of the physical activity on all the three sites is provided in Chart-1.

Chart-1
DATA REGARDING WATER COURSES

SR. NO.		SULTANPUR BASHMOOR NIKKI CHATTA	BLOCK - 6 WATERCOURSE	BLOCK - 2 WATERCOURSE
1.	Minor Name if exisits	Ram Nagar	Kot Hara	Nil
2.	Operating Period of Minor	In Kharif Only	Occosionally in Kharif	Nil
3.	Water Course Length	2200 ft.	2296 ft.	3000 ft.
4.	Water Course Share Holder	12	24	4

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5.	Source of Water	Irrigation Tubewell	Irrigation Tubewell Drainage Effluent	Tubewell Drainage Effluent
6.	Command Area	187 Acres		70 Acres
7.	Water Course Lining	1150 ft.	1500 ft.	1300 ft.
8.	Farmers Benefits	12	4	4
9.	Command Area Benefitted	187	80.45	70

In all the three cases, farmers shared 30% of the capital cost and provided the labor and mason for the watercourse construction/lining.

However, the watercourses were designed for the total anticipated discharges. In the later site, there were 24 farmers in the command area. They all were instrumental in organizing themselves but it is a pity that water was made available to only four farmers because of non-availability of drainage effluents.

Since this is an on-going project, PCRWR will continue collecting data for looking at various variables in determining the over all socio-economics structure of the society.

Discussion:

At Qadirabad Site, the concept of having a water users association which is responsible for decision making regarding the planning and management of water from various sources such as planning, tubewells and reuse of water from the drainage project was good and has not been tried anywhere. Farmers were supposed to operate the system totally on their own. Farmers in general saw the benefits of the cooperation and the introduction of the technology. There were indications that they were unhappy about the too much involvements of Government functionaries in making decision for them. They believed in the democratization of the decision making process about the water distribution but at the same time they were influenced by the political power of the some and by the biradri system.

Overall, PCRWR is looking forward to study the post project socio-economic-technical mechanism of the change with the introduction of the technology package. Since this project is of the first kind where the farmers will be using and reusing the

water and are responsible for the operation of drainage and irrigation structures, the information produced by this project will provide guidelines for necessary change in the policy of water management.

8. Discussion and Conclusion:

We are lucky to have to go through with both kind of situations as mentioned earlier i.e. organization emerging from within the farmers and formed with the help of government functionaries. In Qadirabad, the EWU and DRIP teams, in formal and informal meetings with local farmers, educated them about the benefits of formation of water users associations and installation & operation of tile drainage technology and lined watercourses. They were invited to see the movies of pre-project land situation in Sindh, tile drainage installation work and past projects conditions of the irrigated areas where tile drainage work was completed. Initially a good number of farmers agreed to participate in the project implementation through sharing the cost and labour. However at a later stage due to the interference of their leaders, they decided not to in participate in the sharing of the cost & labor, although they were interested to implement the project and it was the collective decision of the farmers.

In Shah Dheri, an informal water user association existed for development, maintenance of operation of water channels for at least two centuries. Though Khan is still strong, but the whole community due to its tribal structure, has organized itself informally in the old fashion. They have organized themselves to construct and maintain the irrigation structure to utilize the water resources from the Shah Dehri Khowr. There are 83 beneficiaries of the irrigation system who are practicing a water distribution system. They participate with labor and manpower for the maintenance of water channel and diversion bund at Shah Dheri Khowr. Now they have formed a formal WUA to run the whole system more scientifically. They have elected the President and the General Secretary of the WUA. Majority of the qater users are active in the functioning of the water users association and those who were not members previously are showing their willingness to become members of it.

able 1/A TOTAL LAND HOLDING WITH CULTIVABLE AND UN-CULTIVABLE LAND IN QADIRABAD SITE -2

Farmer No.	As Owner	As Tenant	By Tenant	Total	LAND HOLDING: Cultivated Irrigated Acres	Un-Irrigated	Un-Cultivated	Total	UN-CULTIVATED: Water Logging	Salinity	Water Shortage
1	60	-	-	60	60	-	23	83	-	-	23
2	30	-	-	30	30	-	8	38	-	-	8
3	15	50	-	65	50	15	10	75	-	-	10
4	20	-	-	20	20	-	1	21	-	-	1
5	5	-	-	5	5	-	3	8	-	-	3
6	-	30	-	30	30	-	-	30	-	-	-
7	8	-	-	8	8	-	2	10	-	-	2
8	-	5	-	5	5	-	-	5	-	-	-
9	9	-	-	9	9	-	2	11	-	-	2
10	5	-	-	5	-	-	5	5	-	-	5
11	30	-	-	30	25	-	5	30	-	-	5
12	20	30	-	50	50	-	30	80	-	-	30
13	30	-	-	30	24	-	6	30	-	-	6
14	35	-	-	35	25	10	-	35	-	-	-
15	18	-	-	18	18	-	-	18	-	-	-
Total:	285	115	0	400	359	25	95	479	0	0	95
Avg:	21.92	28.75		26.67	25.64	12.50	8.64	31.93			8.64

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Table 2-A: Total Land Holding with Cultivable and Uncultivable Land in Shah Dehri Area

Sr. No.	Land Holding							Total	Uncultivable Land Due to		
	As Owner	As Tenant	By Tenant	Total	Cultivated Irrigated Kanal	Un-Irrigated	Un-Culti-vated		Water Logging	Salinity	Water Shortage
1	-	3	-	3	3	-	-	3	-	-	-
2	-	6	-	6	6	-	-	6	-	-	-
3	-	5	-	5	5	-	-	5	-	-	-
4	-	5	-	5	5	-	-	5	-	-	-
5	-	5	-	5	5	-	-	5	-	-	-
6	8	-	12	20	8	12	-	20	-	-	-
7	28	-	-	28	28	-	-	28	-	-	-
8	18	-	-	18	18	-	-	18	-	-	-
9	-	18	-	18	18	-	-	18	-	-	-
10	18	-	-	18	18	-	-	18	-	-	-
11	6	-	-	6	6	-	-	6	-	-	-
12	-	9	-	9	9	-	-	9	-	-	-
13	4	-	-	4	4	-	-	4	-	-	-
14	5	-	-	5	5	-	-	5	-	-	-
15	-	12	-	12	12	-	-	12	-	-	-
16	6	-	-	6	6	-	-	6	-	-	-
17	5	-	-	5	5	-	-	5	-	-	-
18	-	8	-	8	8	-	-	8	-	-	-
19	1.5	-	-	1.5	1.5	-	-	1.5	-	-	-
20	-	5	-	5	5	-	-	5	-	-	-
21	20	-	-	20	20	-	-	20	-	-	-
22	36	-	-	36	36	-	-	36	-	-	-
23	-	16	-	16	16	-	-	16	-	-	-
24	4	-	-	4	4	-	-	4	-	-	-
25	50	-	-	50	50	-	-	50	-	-	-
26	2	-	-	2	2	-	-	2	-	-	-
27	2	-	-	2	2	-	-	2	-	-	-
28	6	-	-	6	6	-	-	6	-	-	-
29	14	-	-	14	14	-	-	14	-	-	-
30	14	-	-	14	14	-	-	14	-	-	-
31	-	18	-	18	18	-	-	18	-	-	-
32	4	-	-	4	4	-	-	4	-	-	-
33	8	-	-	8	8	-	-	8	-	-	-
34	4	-	-	4	4	-	-	4	-	-	-
35	4	-	-	4	4	-	-	4	-	-	-
36	5	-	-	5	5	-	-	5	-	-	-
37	2	-	-	2	2	-	-	2	-	-	-
38	4	-	-	4	4	-	-	4	-	-	-
39	-	16	-	16	16	-	-	16	-	-	-
40	-	18	-	18	18	-	-	18	-	-	-
41	-	14	-	14	14	-	-	14	-	-	-
42	-	5	-	5	5	-	-	5	-	-	-
43	5	-	-	5	5	-	-	5	-	-	-
44	-	14	-	14	14	-	-	14	-	-	-
45	-	12	-	12	4	8	-	12	-	-	-
46	6	-	-	6	6	-	-	6	-	-	-
47	8	-	-	8	8	-	-	8	-	-	-

Table 2-A (Continued)

48	-	8	-	8	8	-	-	8	-	-	-
49	-	24	-	24	24	-	-	24	-	-	-
50	24	-	-	24	24	-	-	24	-	-	-
51	4	-	-	4	4	-	-	4	-	-	-
52	2	-	-	2	2	-	-	2	-	-	-
53	2	-	-	2	2	-	-	2	-	-	-
54	3	-	-	3	3	-	-	3	-	-	-
55	4	-	-	4	4	-	-	4	-	-	-
56	-	14	-	14	14	-	-	14	-	-	-
57	-	14	-	14	14	-	-	14	-	-	-
58	-	5	-	5	5	-	-	5	-	-	-
59	2	-	-	2	2	-	-	2	-	-	-
60	-	20	-	20	20	-	-	20	-	-	-
61	25	-	-	25	25	-	-	25	-	-	-
62	20	-	-	20	20	-	-	20	-	-	-
63	-	20	-	20	20	-	-	20	-	-	-
64	-	6	-	6	6	-	-	6	-	-	-
65	-	50	-	50	50	-	-	50	-	-	-
66	-	24	-	24	24	-	-	24	-	-	-
67	16	-	-	16	16	-	-	16	-	-	-
68	14	-	-	14	14	-	-	14	-	-	-
69	-	-	30	30	30	-	-	30	-	-	-
70	5	-	15	20	5	15	-	20	-	-	-
71	-	14	-	14	14	-	-	14	-	-	-
72	-	6	-	6	6	-	-	6	-	-	-
73	10	-	-	10	10	-	-	10	-	-	-
74	3	-	-	3	3	-	-	3	-	-	-
75	2	-	-	2	2	-	-	2	-	-	-
76	12	-	17	29	12	17	-	29	-	-	-
77	-	8	-	8	8	-	-	8	-	-	-
78	-	32	-	32	14	18	-	32	-	-	-
79	-	17	-	17	17	-	-	17	-	-	-
80	-	14	-	14	14	-	-	14	-	-	-
81	-	12	-	12	12	-	-	12	-	-	-
82	-	12	-	12	12	-	-	12	-	-	-
83	-	12	-	12	12	-	-	12	-	-	-
Total:	446	501	74	1021	951	70	0	1021	0	0	0
Average	9.90	13.54	18.50	12.30	11.45	14.00		12.30			

Table 2-A

'able 3-A Respondent Use of Land Under Different Crops at Qadirabad Site-2

Farmer No.	Name of Respondnet	Cultivable Land	LAND USE UNDER DIFFERENT CROPS			
			KHARIF		RABBI	
			Rice	Other	Wheat	Fodder
1	Liqaqat Jurah	60	60	-	30	-
2	Khalid Pervaiz Jurah	30	30	-	-	-
3	Amanullah	65	65	-	55	10
4	Ch. Amin Chattah	20	20	-	15	5
5	Ch. Asadullah Chattha	5	5	-	5	-
6	Muhammad Khan	30	27	-	25	5
7	Khalid Mehmood	8	8	-	6	2
8	Inayatullah	5	5	-	5	-
9	Irshadullah	9	9	-	9	-
10	Inayatullah		5	-	18	2
11	Ch. Ijaz Ahmad	25	25	-	15	10
12	Ch. Ehsanullah	50	50	-	50	-
13	Ch. Altafullah	24	24	-	20	4
14	Ch. Ashraf	35	25	-	20	5
15	Nazar Muhammad	18	18	-	13	-
	Total:-	384	376	0	291	43
	Average:-	27.43	25.07		20.79	5.38

4-A Agricultural Economics Data Qadirabad Site-2

Crop	No.of Farmer	Cropped Area		Yield			Expenditure			Price	Income			Net Benefit		
		Total	Avg/ Farmer	Total	Avg/ Farmer	Avg/ Acre	Total	Avg/ Farmer	Avg/ Acre	Per Mond	Total	Avg/ Farmer	Avg/ Acre	Total	Avg/ Farmer	Avg/ Acre
WHEAT	14	231	20.79	5233	421.35	20.27	468200	33442.86	1608.33	124.54	723425	52101.79	2506.62	251325	18658.93	897.68
RICE	15	372	25.07	13300	920.00	36.70	636700	42446.67	1693.35	132.53	1853630	123579.33	4930.03	1216930	81132.67	3236.69
FODDER	8	40	5.38	2600	322.50	61.86	29500	3687.50	696.05	12.00	31130	3887.50	725.12	1630	210.00	39.07
OTHERS	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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e 5-A Respondent Income and Expenditure in Qadirabad Site -2

mer.	Family Size	Income Agri.	Income Other	Income Total	Expenditure H/H	Expenditure Agri.	Expenditure Total	Preofit	Per Capita Profit
1	10	456000	200000	656000	240000	165000	405000	251000	25100
2	8	200000	-	200000	72000	60000	132000	68000	8500
3	6	506500	150000	656500	144000	207500	351500	305000	50833
4	12	250000	48000	298000	120000	52500	172500	125500	10458
5	21	225000	-	225000	144000	75000	219000	6000	286
6	13	231600	20000	251600	48000	88100	136100	115500	8885
7	5	64800	-	64800	30000	26600	56600	8200	1640
8	15	47625	15000	62625	32000	15500	47500	15125	1008
9	9	823350	-	823350	48000	29700	77700	745650	82850
10	4	138200	-	138200	36000	50400	86400	51800	12950
11	11	120600	20000	140600	72000	64500	136500	4100	373
12	10	259200	5000	264200	96000	140000	236000	28200	2820
13	7	124000	51600	175600	66000	68000	134000	41600	5943
14	13	148000	86400	234400	120000	73000	193000	41400	3185
15	12	168300	-	168300	72000	52200	124200	44100	3675
tal	156	3763175	596000	4359175	1340000	1168000	2508000	1851175	218506
g:	10	250878	99333	290612	89333	77867	167200	123412	14567

Table 6-A: Respondent Use of Land under Different Crops in Shah Dehri

Farmer No.	Name of Respondent	Total Cultivable Land	KHARIF	RABI CROPS		
			Maize	Wheat	Onion	Fodder
1	Said Usman	3	3	3	-	-
2	Gul Nazar	6	6	2	4	-
3	Abdul Qasim	5	5	4	-	1
4	Talizar	5	5	3	-	2
5	Nadir Khan	5	5	4	-	2
6	Zaheer Khan	20	20	12	6	2
7	Sher Bahadur Khan	28	28	24	1	3
8	Toor Khan	18	18	12	2	4
9	Abdul Bashir	18	18	9	9	-
10	Shah Nasir Khan	18	18	14	-	4
11	Muhammad Nazir	6	6	4	-	2
12	Abdul Rafi/Gul Halim	9	9	4	-	5
13	Abdul Wasay	4	4	-	4	-
14	Shah Tumroze	5	5	-	3	2
15	Sahibzada	12	12	6	2	4
16	Muhammad Ali	6	6	4	-	2
17	Lali	5	5	3	-	2
18	Muhammad	8	8	5	-	3
19	Muqadar Jan	1.5	1.5	-	1	0.5
20	Moamber Khan	5	5	-	5	-
21	Khurshid anwar	20	20	14	2	6
22	Manjowar	36	36	20	8	3
23	Noor Muhammad	16	16	8	-	2
24	Muhammad Ali	4	4	-	-	-
25	Said Faqir	50	50	25	5	4
26	Rahim Dad Khan	2	2	-	-	2
27	Dilawar	2	2	-	-	1
28	Fareed	6	6	2	2	4
29	Ain-ul-Haq	14	14	5	5	4
30	Fazal-ur-Rahman	14	14	5	5	8
31	Jehanzaib	18	18	10	2	6
32	Muhammad S/o Abdullah	4	4	-	1	3
33	Fareedoon	8	8	6	-	2
34	Luky	4	4	-	4	-
35	Muhammad Akbar	4	4	-	-	4
36	Sher Ali	5	5	3	-	2
37	Bakht-e-Rawan	2	2	-	1	1
38	Siraj Ahmad	4	4	-	-	4
39	Sher Malik	16	16	12	-	4
40	Abdul Malik	18	18	4	6	8
41	Omar Ali	14	14	6	-	8
42	Juma Said	5	5	3	-	2
43	Abdul Jalil	5	5		-	5
44	Muhammad Khan/Wazir	14	14	24	-	20
45	Aman-ul-Malik	12	12	4	4	4
46	Muhammad Sher Ali	6	6	3	-	3
47	Fazal Ahmad	8	8	5	-	3
48	Jamal-ud-Din	8	8	4	-	4

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Table 6-A (Contd)

49	Faqir Muhammad	24	24	14	4	6
50	Fazal-e-Jamil	24	24	18	2	4
51	Ayub Khan	4	4	3	-	1
52	Shad Muhammad	2	2	-	-	2
53	Umar Khan	2	2	-	2	-
54	Ayub Khan S/o Dost Muhammad	3	3	-	-	3
55	Fazal Ahmad	4	4	-	-	4
56	Dost Muhammad Khan	14	14	8	-	6
57	Amin	14	14	8	4	6
58	Cernnay	5	5	-	-	5
59	Ishaq	2	2	1	-	1
60	Muhammad Bacha/Naseem	20	20	8	4	8
61	Sheeren Khan	25	25	12	8	5
62	Sultanat Khan	20	20	10	4	6
63	Fareedon Khan	20	20	10	4	6
64	Muhabbat Khan	6	6	4	2	-
65	Sher Zada/Bahadur Khan	50	50	20	15	15
66	Zameen/Bahdar	24	24	12	4	8
67	Bakht-e-Karam	16	16	12	-	4
68	Habib Khan	14	14	8	2	4
69	Usman Ali	30	30	25	-	5
70	Rahim Dil	20	20	10	5	5
71	Sultanat Khan/Nimroze	14	14	6	4	4
72	Omar Muhammad/Sultan-e-Ruom	6	6	4	-	2
73	Tota Khan	10	10	7	-	3
74	Mukkarram Khan	3	3	3	-	-
75	Raza Khan/Yousaf Jamal	2	2	-	2	-
76	Inayat-ul-Lah	29	29	12	10	7
77	Muhammad Hassan	8	8	-	2	6
78	Hazrat Ali	32	32	25	5	2
79	Zul Khan	17	17	6	2	4
80	Bakhtiar	14	14	8	2	4
81	Muhammad Ali	12	12	2	6	4
82	Zazor	12	12	6	2	4
83	Khayber	12	12	8	-	4
	Total:-	1021	1021	546	177	304
	Average:-	12.30	12.30	8.67	4.02	4.22

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Table 7-A

Agriculture Economics Data Shah Dheri Site

Sr. No.	Crop	No.of Farmer	Cropped Area Total	Cropped Area Avg/Farmer	Yield Total	Yield Avg/Farmer	Yield Avg/Acre	Expenditure Total	Expenditure Avg/Farmer	Expenditure Avg/Acre	Price Per Mond	Income Total	Income Avg/Farmer	Income Avg/Acre	Net Benefit Total	Net Benefit Avg/Farmer	Net Benefit Avg/Acre
1	Wheat	63	546.00	8.67	1099.00	17.44	2.01	52000.00	825.40	95.24	118.00	130990.00	2079.21	239.91	78990.00	1253.81	144.67
2	Onion	44	177.00	4.02	1583.00	35.98	8.94	16515.00	375.34	93.31	95.00	149850.00	3405.68	846.61	133335.00	3030.34	753.31
3	Shuftal/Clover	72	304.00	4.22	14780.00	205.28	48.62	15725.00	218.40	51.73	10.00	147800.00	2052.78	486.18	132075.00	1834.38	434.46
4	Maize	83	1020.50	12.30	3061.50	36.89	3.00	132665.00	1598.37	130.00	120.00	367380.00	4426.27	360.00	234715.00	2827.89	230.00

Table 8-A Respondent Income and Expenditure in Shah Dheri Site

Farmer No.	Family Size	Income: Agri Income	Income: Other	Income: Total	Expenditure: H/H	Expenditure: Agri	Expenditure: Total	Profit	Per Capita Profit
1	6	1800	36000	37800	30000	690	30690	7110	1185.00
2	7	6010	36000	42010	40000	1260	41260	750	107.14
3	10	2780	25000	27780	24000	1100	25100	2680	268.00
4	39	3520	24000	27520	24000	1050	25050	2470	63.33
5	5	3760	24000	27760	24000	1150	25150	2610	522.00
6	9	15680	25000	40680	36000	4500	40500	180	20.00
7	11	18140	30000	48140	42000	5790	47790	350	31.82
8	7	13760	20000	33760	28000	3940	31940	1820	260.00
9	14	18720	36000	54720	48000	3960	51960	2760	197.14
10	7	11440	25000	36440	30000	3940	33940	2500	357.14
11	7	3960	30000	33960	30000	1280	31280	2680	382.86
12	20	6780	30000	36780	32000	1820	33820	2960	148.00
13	12	4640	20000	24640	20000	920	20920	3720	310.00
14	10	4500	36000	40500	36000	1050	37050	3450	345.00
15	13	8820	36000	44820	36000	2520	38520	6300	484.62
16	9	4120	60000	64120	50000	1280	51280	12840	1426.67
17	8	3380	60000	63380	60000	1050	61050	2330	291.25
18	8	5880	20000	25880	24000	1690	25690	190	23.75
19	11	1790	54000	55790	50000	320	50320	5470	497.27
20	12	4050	24000	28050	24000	900	24900	3150	262.50
21	15	15100	84000	99100	60000	4500	64500	34600	2306.67
22	16	26960	10000	36960	28000	7630	35630	1330	83.13
23	11	8680	24000	32680	25000	2980	27980	4700	427.27
24	10	1440	24000	25440	24000	520	24520	920	92.00
25	15	28400	36000	64400	48000	9700	57700	6700	446.67
26	9	1720	48000	49720	48000	360	48360	1360	151.11
27	9	1270	86000	87270	70000	310	70310	16960	1884.44
28	12	6680	20000	26680	24000	1420	25420	1260	105.00
29	11	13240	12000	25240	20000	3120	23120	2120	192.73
30	8	14790	36000	50790	45000	3220	48220	2570	321.25
31	7	13580	18000	31580	26000	3600	29600	1980	282.86
32	10	3440	24000	27440	24000	770	24770	2670	267.00
33	15	4080	36000	40080	36000	1140	37140	2940	196.00
34	9	5440	15000	20440	18000	920	18920	1520	168.89
35	8	3440	36000	39440	36000	720	36720	2720	340.00
36	11	3000	48000	51000	36000	750	36750	14250	1295.45
37	9	1720	36000	37720	36000	390	36390	1330	147.78
38	12	3040	48000	51040	48000	760	48760	2280	190.00
39	15	10640	36000	46640	40000	3480	43480	3160	210.67
40	14	16680	40000	56680	48000	3700	51700	4980	355.71
41	7	10540	24000	34540	30000	2780	32780	1760	251.43
42	12	3550	36000	39550	35000	1050	36050	3500	291.67
43	7	4300	24000	28300	24000	900	24900	3400	485.71
44	10	21040	24000	45040	36000	5220	41220	3820	382.00
45	8	9760	36000	45760	42000	2660	44660	1100	137.50
46	8	4710	36000	40710	36000	1230	37230	3480	435.00
47	6	5630	30000	35630	30000	1690	31690	3940	656.67

Table 8-A Respondent Income and Expenditure in Shah Dheri Site

Farmer No.	Family Size	Income: Agri Income	Income: Other	Income: Total	Expenditure: H/H	Expenditure: Agri	Expenditure: Total	Profit	Per Capita Profit
48	27	5920	60000	65920	60000	1560	61560	4360	161.48
49	10	17600	30000	47600	40000	5200	45200	2400	240.00
50	8	17140	36000	53140	45000	5240	50240	2900	362.50
51	14	2690	36000	38690	36000	870	36870	1820	130.00
52	6	1720	36000	37720	35000	360	35360	2360	393.33
53	8	2720	36000	38720	35000	460	35460	3260	407.50
54	11	2580	30000	32580	30000	540	30540	2040	185.45
55	4	3440	18000	21440	18000	680	18680	2760	690.00
56	15	10040	36000	46040	40000	2980	42980	3060	204.00
57	10	14040	24000	38040	32000	3320	35320	2720	272.00
58	10	4300	30000	34300	32000	900	32900	1400	140.00
59	4	1470	24000	25470	24000	410	24410	1060	265.00
60	18	17280	36000	53280	45000	4040	49040	4240	235.56
61	15	22500	96000	118500	84000	5050	89050	29450	1963.33
62	13	15900	80000	95900	60000	4220	64220	31680	2436.92
63	10	15900	12000	27900	20000	4300	24300	3600	360.00
64	8	4160	24000	28160	24000	1380	25380	2780	347.50
65	12	44000	18000	62000	48000	10750	58750	3250	270.83
66	7	19640	40000	59640	48000	5120	53120	6520	931.43
67	10	10760	36000	46760	36000	3480	39480	7280	728.00
68	10	10640	48000	58640	42000	3020	45020	13620	1362.00
69	7	18300	84000	102300	84000	6650	90650	11650	1664.29
70	11	16100	84000	100100	84000	4475	88475	11625	1056.82
71	12	12240	18000	30240	24000	2940	26940	3300	275.00
72	6	3960	18000	21960	18000	1200	19200	2760	460.00
73	14	6500	14000	20500	18000	2150	20150	350	25.00
74	8	1830	35000	36830	32000	690	32690	4140	517.50
75	11	2720	72000	74720	60000	420	60420	14300	1300.00
76	10	23340	60000	83340	60000	6220	66220	17120	1712.00
77	7	6880	36000	42880	36000	1600	37600	5280	754.29
78	12	21970	30000	51970	36000	7160	43160	8810	734.17
79	8	11320	30000	41320	36000	3210	39210	2110	263.75
80	11	10040	40000	50040	42000	2860	44860	5180	470.91
81	12	12840	36000	48840	36000	2600	38600	10240	853.33
82	10	8820	36000	44820	36000	2560	38560	6260	626.00
83	7	8320	24000	32320	24000	2560	26560	5760	822.86
	885	796020	2981000	3777020	3121000	216905	3337905	439115	42910.8
	11	9591	35916	45506	37602	2613	40216	5291	517

Table 9-A Respondent Use of Irrigation Source and Irrigation Methods in Qadirabad Site - 2

Farmer No.	Cultivable Land	IRRIGATION SOURCE: MINOR Kharif	MINOR Rabbi	TUBEWELL Kharif	TUBEWELL Rabbi	IRRIGATION METHOD: Basin	Furrow	Wild Flodding
1	60	60	60	60	60	-	-	60
2	30	30	-	30	30	-	-	30
3	65	50	50	50	50	-	-	65
4	20	20	20	20	20	-	-	20
5	5	5	5	-	-	-	-	5
6	30	30	30	15	15	-	-	30
7	8	8	8	8	8	-	-	8
8	5	5	5	-	-	-	-	5
9	9	9	9	-	-	-	-	9
10	5	-	-	-	-	-	-	-
11	25	25	25	25	25	-	-	25
12	50	50	50	50	50	-	-	50
13	24	24	24	24	24	-	-	24
14	25	25	25	25	25	-	-	25
15	18	18	18	-	-	-	-	18
Total:	379	359	329	307	307	0	0	374
Avg:	25.27	25.64	25.31	30.70	30.70			26.71

Table 10-A: Respondent Use of Irrigation Source and Irrigation Methods in Shah Dehri

Farmer No.	Total Cultivable Land	Irrigation Pattern: Diversion Channel	Irrigation Pattern: Barani	Irrigation Methods: Basin	Irrigation Methods: Furrow	Irrigation Methods: Wild Flooding
1	3	3	-	-	3	-
2	6	6	-	-	6	-
3	5	5	-	-	5	-
4	5	5	-	-	5	-
5	5	5	-	-	5	-
6	20	8	12	-	20	-
7	28	28	-	-	28	-
8	18	18	-	-	18	-
9	18	18	-	-	18	-
10	18	18	-	-	18	-
11	6	6	-	-	6	-
12	9	9	-	-	9	-
13	4	4	-	-	4	-
14	5	5	-	-	5	-
15	12	12	-	-	12	-
16	6	6	-	-	6	-
17	5	5	-	-	5	-
18	8	8	-	-	8	-
19	1.5	1.5	-	-	1.5	-
20	5	5	-	-	5	-
21	20	20	-	-	20	-
22	36	36	-	-	36	-
23	16	16	-	-	16	-
24	4	4	-	-	4	-
25	50	50	-	-	50	-
26	2	2	-	-	2	-
27	2	2	-	-	2	-
28	6	6	-	-	6	-
29	14	14	-	-	14	-
30	14	14	-	-	14	-
31	18	18	-	-	18	-
32	4	4	-	-	4	-
33	8	8	-	-	8	-
34	4	4	-	-	4	-
35	4	4	-	-	4	-
36	5	5	-	-	5	-
37	2	2	-	-	2	-
38	4	4	-	-	4	-
39	16	16	-	-	16	-
40	18	18	-	-	18	-
41	14	14	-	-	14	-
42	5	5	-	-	5	-
43	5	5	-	-	5	-
44	14	14	-	-	14	-
45	12	4	8	-	12	-
46	6	6	-	-	6	-
47	8	8	-	-	8	-
48	8	8	-	-	8	-

Table 10-A (Contd)

49	24	24	-	-	24	-
50	24	24	-	-	24	-
51	4	4	-	-	4	-
52	2	2	-	-	2	-
53	2	2	-	-	2	-
54	3	3	-	-	3	-
55	4	4	-	-	4	-
56	14	14	-	-	14	-
57	14	14	-	-	14	-
58	5	5	-	-	5	-
59	2	2	-	-	2	-
60	20	20	-	-	20	-
61	25	25	-	-	25	-
62	20	20	-	-	20	-
63	20	20	-	-	20	-
64	6	6	-	-	6	-
65	50	50	-	-	50	-
66	24	24	-	-	24	-
67	16	16	-	-	16	-
68	14	14	-	-	14	-
69	30	30	-	-	30	-
70	20	5	15	-	20	-
71	14	14	-	-	14	-
72	6	6	-	-	6	-
73	10	10	-	-	10	-
74	3	3	-	-	3	-
75	2	2	-	-	2	-
76	29	12	17	-	29	-
77	8	8	-	-	8	-
78	32	14	18	-	32	-
79	17	17	-	-	17	-
80	14	14	-	-	14	-
81	12	12	-	-	12	-
82	12	12	-	-	12	-
83	12	12	-	-	12	-
Total	1021	951	70	0	1021	0
Average	12.30	11.45	0.84	0.00	12.30	0.00

POST PROJECT DATA AT SHAH DEER SITE (SWAT)

Sr. No.	Name	PROJECT INTERVENTION								BENEFITS PERCEIVED		
		Knowledge	Parti-cipated	How Parti-cipated	Water Delivery Increase	How Much %	Water Shortage	Still Land Un-Irrigated	Still Land Un-Cultivated	By W.C.L.	By WUA	Change in Cropping Pattern
1	Said Usman	Yes	Yes	4	Yes	90	Yes	No	No	1 to 6	1 to 5	Yes
2	Gul Nazar	Yes	Yes	4	Yes	70	No	No	No	1 to 6	1 to 5	Yes
3	Abdul Qasim	Yes	Yes	2,4	Yes	40	No	No	No	1 to 6	1 to 5	No
4	Talizar	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
5	Hadir Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
6	Zaheer Khan	Yes	Yes	4	Yes	70	No	Yes (W)	No	1 to 7	1 to 5	Yes
7	Sher Bahadur Khan	Yes	Yes	2,4	Yes	50	Yes	No	No	1 to 6	1 to 5	Yes
8	Toor Khan	Yes	Yes	4	Yes	90	No	No	No	1 to 6	1 to 5	Yes
9	Abdul Bashir	Yes	Yes	1	Yes	50	No	No	No	1 to 6	1 to 5	Yes
10	Shah Nasir Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
11	Muhammad Nazir	Yes	Yes	2,4	Yes	60	No	No	No	1 to 6	1 to 5	No
12	Abdul Rafi/Gul Halim	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
13	Abdul Wasay	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
14	Shah Tumroze	Yes	Yes	Nothing	Yes	30	No	No	No	1 to 6	1 to 5	No
15	Sahibzada	Yes	Yes	4	Yes	55	No	No	No	1 to 6	1 to 5	No
16	Muhammad Ali	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
17	Lali	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
18	Muhammad	Yes	Yes	Nil owner paid	Yes	50	No	No	No	1 to 6	1 to 5	No
19	Muqadar Jan	Yes	Yes	4	Yes	40	No	No	No	1 to 6	1 to 5	No
20	Noamber Khan	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
21	Khurshid anwar	Yes	Yes	4	Yes	45	No	No	No	1 to 6	1 to 5	No
22	Manjowar	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
23	Noor Muhammad	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
24	Muhammad Ali	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
25	Said Faqir	Yes	Yes	Nil	Yes	50	No	No	No	1 to 6	1 to 5	No
26	Rahim Dad Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
27	Dilawar	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
28	Fareed	Yes	Yes	Nil	Yes	50	No	No	No	1 to 6	1 to 5	No
29	Ain-ul-Haq	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
30	Fazal-ur-Rahman	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
31	Jehanzaib	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
32	Muhammad S/o Abdullah	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
33	Fareedoon	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
34	Luky	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
35	Muhammad Akbar	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
36	Sher Ali	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
37	Bakht-e-Rawan	Yes	Yes	4	Yes	35	No	No	No	1 to 6	1 to 5	No
38	Siraj Ahmad	Yes	Yes	4	Yes	50	Yes	No	No	1 to 6	1 to 5	No
39	Sher Malik	Yes	Yes	4	Yes	40	No	No	No	1 to 6	1 to 5	No
40	Abdul Malik	Yes	Yes	4	Yes	40	No	No	No	1 to 6	1 to 5	No
41	Omar Ali	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
42	Juma Said	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
43	Abdul Jalil	Yes	Yes	2,4	Yes	33	No	No	No	1 to 6	1 to 5	No

POST PROJECT DATA AT SHAH DEER SITE (SWAT)

Sr. No.	Name	PROJECT INTERVENTION								BENEFITS PERCEIVED		
		Knowledge	Parti-cipated	How Parti-cipated	Water Delivery Increase	How Much %	Water Shortage	Still Land Un-Irrigated	Still Land Un-Cultivated	By W.C.I.	By WUA	Change in Cropping Pattern
44	Muhammad Khan/Wazir	Yes	Yes	4	Yes	40	Yes	No	No	1 to 6	1 to 5	No
45	Aman-ul-Malik	Yes	Yes	Nothing	Yes	50	No	Yes	No	1 to 7	1 to 5	No
46	Muhammad Sher Ali	Yes	Yes	4	Yes	40	No	No	No	1 to 6	1 to 5	No
47	Fazal Ahmad	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
48	Jamal-ud-Din	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
49	Faqir Muhammad	Yes	Yes	4	Yes	60	No	No	No	1 to 6	1 to 5	No
50	Fazal-e-Jamil	Yes	Yes	4	Yes	45	No	No	No	1 to 6	1 to 5	No
51	Ayub Khan	Yes	Yes	4	Yes	100	No	No	No	1 to 6	1 to 5	No
52	Shad Muhammad	Yes	Yes	2,4	Yes	45	No	No	No	1 to 6	1 to 5	No
53	Umar Khan	Yes	Yes	4	Yes	45	No	No	No	1 to 6	1 to 5	No
54	Ayub Khan S/o Dost Muhammad	Yes	Yes	4	Yes	35	No	No	No	1 to 6	1 to 5	No
55	Fazal Ahmad	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
56	Dost Muhammad Khan	Yes	Yes	4	Yes	70	No	No	No	1 to 6	1 to 5	No
57	Amin	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
58	Cernnay	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
59	Ishaq	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
60	Muhammad Bacha/Naseem	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
61	Sheeren Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
62	Sultanat Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
63	Fareedon Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
64	Muhabbat Khan	Yes	Yes	4	Yes	40	No	No	No	1 to 6	1 to 5	No
65	Sher Zada/Bahadur Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
66	Zameen/Bahdar	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
67	Bakht-e-Karam	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
68	Habib Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
69	Usman Ali	Yes	Yes	4	Yes	70	No	No	No	1 to 6	1 to 5	Yes
70	Rahim Dil	Yes	Yes	2,4	Yes	50	No	Yes	No	1 to 7	1 to 5	No
71	Sultanat Khan/Nimroze	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
72	Omar Muhammad/Sultan-e-Ruom	Yes	Yes	4	Yes	40	No	No	No	1 to 6	1 to 5	No
73	Tota Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	No
74	Mukkarram Khan	Yes	Yes	2,4	Yes	50	No	No	No	1 to 6	1 to 5	Yes
75	Raza Khan/Yousaf Jamal	Yes	Yes	2,4	Yes	100	No	No	No	1 to 6	1 to 5	No
76	Inayat-ul-Lah	Yes	Yes	Nil	Yes	60	Yes	Yes	No	He has not been proivded water for irrigation		
77	Muhammad Hassan	Yes	Yes	4	Yes	30	No	No	No	1 to 6	1 to 5	No
78	Hazrat Ali	Yes	Yes	2,4	Yes	50	Yes	Yes	No	1 to 7	1 to 5	No
79	Zal Khan	Yes	Yes	4	Yes	30	No	No	No	1 to 6	1 to 5	No
80	Bakhtiar	Yes	Yes	4	Yes	40	No	No	No	1 to 6	1 to 5	No
81	Muhammad Ali	Yes	Yes	4	Yes	30	No	No	No	1 to 6	1 to 5	No
82	Zazor	Yes	Yes	4	Yes	50	No	No	No	1 to 6	1 to 5	No
83	Khayber	Yes	Yes	4	Yes	40	No	No	No	1 to 6	1 to 5	No
	Total:-					4198						
	Average:-					52.48						

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Table 11 CROPPING PATTERN

Sr.No.	Crop	Before Intervention	After Intervention
1	Wheat	431.50	431.50
2	Onion	126.63	172.13
3	Maize	554.00	519.00
4	Tomato	24.00	34.00
5	Fodder	171.00	166.00
6	Rice	1.00	1.00
	Kharif	555	520
	Rabi	753.125	803.635
	Total:	1308.125	1323.635

Change in Cropping Indensity = 1.63%

Potential Role of Water Users Associations for Better Water Management at the Farm Level: Synthesis of Nine Studies

Bashir A Chandio, M Azam, and M Zafar Iqbal Khan[1/]

ABSTRACT

Considering that little monitoring of the performance of water users associations was conducted until 1986, nine studies to determine the success of water user organizations were recently conducted by social scientists and anthropologists of various universities in Pakistan under the Encouraging Water Users (EWU) sub-project. Based on the fact that the on-farm water management program was launched in the early seventies and that water users associations were not provided legal protection until 1981, the studies also searched for any institutional constraints limiting the viability of the associations.

Out of nine studies, three were done in Balochistan to determine community impact and tribal affiliations on collective management of karezes and tubewells. Studies suggested that the tribal system could readily form into a water users association. The studies noted also that the tribal system was a more appropriate system for installation of tubewells than rehabilitation of karezes. Poverty emerged as a larger constraint against the success of water management programs.

The study on socioeconomics and irrigation system in Swat indicated that the unplanned and disorganized irrigation system is prone to many problems whereas the study on irrigation and society in Chitral revealed that socially organized farmers could manage irrigation water effectively. Two studies in Sindh and one in Punjab reported that water users associations would not help improve irrigation efficiencies unless other considerations were brought under the domain of water users associations. In Barani areas of Punjab, research suggested that because the local irrigation department had shown little interest, water users associations were prime candidates to take responsibility of small dams.

INTRODUCTION

The low productivity in the agriculture sector of Pakistan has been attributed mainly to poor irrigation management. Though irrigation science and engineering has advanced on the basis of research and post-project monitoring the world over, Pakistan's irrigation authorities have not taken advantage of these advances to improve the distribution, conveyance and application of irrigation water. The provincial irrigation departments only administer the distribution of irrigation water up to secondary distributaries. For instance, the water distribution beyond Mogha remained a responsibility of uneducated farmers even though proper utilization of water resources on the farm level could not be made unless improved water management practices conformed with socioeconomic, physical, and agricultural factors. Fortunately, the agriculture department assumed this responsibility in the '70s to improve the irrigation system on the farm level by lining and aligning

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1/ Chairman, Deputy Director and Assistant Director, respectively, Pakistan Council of Research in Water Resources

the watercourse, and by improving field application efficiency via precision land levelling.

The water users associations (WUA) were subsequently recognized as appropriate venues for pursuing equitable distribution of water and resolving disputes. Their formation was encouraged for watercourse rehabilitation, appropriate irrigation scheduling, augmentation of water supplies, and land drainage. But based on his findings that Pipe Committees (WUAs) were not uniform throughout the province, Singh (1983) recommended that intensive government efforts should be made to educate and facilitate the user associations as well as individuals.

Summarizing the experience of pilot projects started by the National Irrigation Administration (NIA) in the Philippines, Bagadion (1989) recommended that NIA should encourage the farmers to participate in planning, constructing, operating and maintaining irrigation systems through irrigation associations. Smout (1990) emphasized that farmers' participation at the outset would result in sustainable schemes.

Outside Pakistan, the concept of water users associations has also been introduced in management and operation of the groundwater schemes. Jackson (1991) commended the performance of WUA on the Madura Project of Indonesia in developing suitable procedures for WUA establishment, training and follow-up. He noted that these procedures could be applied to other similar projects. Based on performances of water users associations in USA, Spain, Argentina and Turkey, Radosevich (1975) suggested that a legal organization of farmers in Pakistan would help increase the agricultural production by improving water management and irrigation efficiencies on the farm level.

In order to enforce the role of water users associations in Pakistan, Cheema (1977) recommended that water users associations should be provided legal cover under the Co-operative Act 1925 and Canal Act 1876. Based on the recommendations of Provincial Seminars organized by the Government of Pakistan (1978), Water Users Associations Ordinances for the North-West Frontier Province (NWFP), Punjab, and Balochistan provinces were ultimately passed in 1981 and in 1982 for Sindh (Arain, 1987). Kausar et al (1985) monitored 20 water users associations in the Punjab constituted under the Cooperative Law and the WUAs Ordinance 1981. They reported that the associations stopped working just after the renovation of the watercourse. WAPDA (1985) evaluated water users associations regarding their effectiveness, role, and responsibilities on the 40 sample watercourses which were improved under Regular Technology. It alleged that WUAs failed to sustain their formal character.

Zafar (1987) studied the social behavior of various community groups of farmers on a single watercourse and opined that the water users associations could serve as centers of mutual cooperation for on-farm activities. Enterprise & Development Consulting (Pvt) Limited (1992) studied the role of water users associations at Kandiaro (Sindh), Lasbella (Balochistan), 6R-Hakra, Pakpattan, Shahkot and Niazbeg (Punjab), and Warsak lift Canal (NWFP). They observed that WUAs motivated farmers to adopt new irrigation techniques and exchange water turns for proper irrigation schedules. These associations assisted the project personnel in selection of demonstration sites, persuaded farmers to participate in and provide extra labor for rehabilitation and maintenance of watercourses. They helped in

identifying the farmer problems and constraints, and in supervising the harvesting and threshing of crops. Under this umbrella, field days and meetings were arranged between farmers and experts. Sometimes these associations even acted as a pressure group on the irrigation and agriculture departments.

This paper synthesizes the results and recommendations made by the researchers of nine studies conducted all over Pakistan under the Encouraging Water Users Program. This paper should provide basic information on the agrarian society and irrigation to help planners and managers of water resources to improve the irrigation system and eventually make it self sustaining.

METHODOLOGY

The Encouraging Water Users (EWU) sub-program was launched in 1986 under the Irrigation Systems Management Research (ISM-R) Program to encourage water users involvement for better water management. The objectives of EWU were:

(a) to evaluate the dynamics of watercourse organizations,

(b) to understand the impediment against the success of such association, and

(c) to foster better water management through action research program.

Because civil engineers were establishing the irrigation system in Pakistan, the system became too technical for the social organization at the watercourse level. Social scientists needed to be involved to help create a system that the organizations could adopt. Even after the formation of the water user associations, the database was not fully developed. For example, the database in Punjab was on such a small scale that regional differences in land ownership and tenancy patterns were not represented. Little attempt was made to monitor the efficiency of newly born water users associations in the country; nor the formal institutional constraints.

A comprehensive research project to conduct research activities in the four provinces and Northern Areas of Pakistan was planned by involving the Anthropology Department of Quaid-e-Azam University, Sociology Department of Punjab University, Rural Sociology Department of Faisalabad Agricultural University, Applied Economics Research Centre of Karachi University, Sindh Agricultural University Tandojam, Institute of Development Economics Islamabad, and Institute of Business Administration of Karachi University. The long-term technical advisor of ISM-R and the EWU Director personally contacted the prospective researchers as well as the head of the above organizations/institutions to seek their collaboration and to motivate the experts to quickly submit viable research proposals. Even then, EWU project got only three research proposals from Department of Anthropology of Quaid-e-Azam University, Department of Rural Sociology of Faisalabad Agricultural University, and Applied Economics Research Centre of Karachi University, respectively. The other institutes were visited again to encourage and motivate the researchers to prepare and submit good research proposals for their area. Sindh Development Study Centre of University of Sindh Jamshoro;

Departments of Geography, Economics, and Sociology of Balochistan University; and Departments of Geography of University of Peshawar, and the Government Jehanzeb College Swat were contacted. Consequently, more research proposals were received which were discussed in a panel of experts where nine research proposals were approved in a joint meeting of PCRWR authorities, Project Officer ISM-R, and Short Term-Technical Advisor. Following are the titles of nine studies:

1) Patterns of Management and Cooperation on Karez System in Balochistan

2) A Comparative Study of Karez and Tubewell Irrigation Systems in Balochistan

3) Irrigation and Land Use in the Kech Valley, Makran

4) Socioeconomics of Irrigation in Swat Valley

5) Irrigation and Society in Chitral District

6) Incentives and Disincentives to Effectively Organize Farmers in Response to Watercourse Improvement in Sindh

7) An Investigation of Small Farmers' Responses to Programs of Watercourse Improvement in Sindh

8) Constraints in the Formation and Functioning of Water Users Associations in Punjab

9) The Social Organization of Small Dam Irrigation in Barani Punjab

Each study was compartmented into distinct phases of:

(a) description and key question formulation;

(b) data collection, management; and

(c) analysis and compilation of results to draw conclusions and foresee policy implications.

Researchers and investigators were appropriately guided through discussions and workshops with technical experts from University of Idaho and Utah State University, USA. From its very inception, the EWU program stressed the need to comprehend the economical, political, administrative, cultural, and family impacts on the agrarian community and on the formation of water user associations to provide an analytical description of the inter-relations between the communal organizations and the inhabitants maintaining an irrigation system. A 1989 symposium provided a forum for the principal investigators of EWU project to explain the central issues and to stimulate active discussion and participation of planners, policy makers, administrators and donors to crystalize the essential issues that each study should pursue. Tirmizi and Parlin (1989) compiled the working papers presented in that symposium and recommended treating them as preliminary papers because the results, conclusions and policy implications would be drawn at a later stage.

The EWU project has sought to provide an opportunity to Pakistan's sociologists and anthropologists to conduct research in the field of water management and has helped them understand the nature and extent of problems involved in irrigation systems of Pakistan. The ethnographic, descriptive and analytical data has been collected through field surveys, interviews and personal observations. The scrutinized information so far generated provides a foundation for future programs on the interdisciplinary irrigation management aspects. This effort should provide a useful base to develop and operate the irrigation system in close cooperation with all those, directly or indirectly, involved in it, and motivate the farming community to pool their resources for scientific management of available water.

RESULTS AND DISCUSSIONS

Research studies on the role of water users association for the implementation of better water management programs were conducted under Encouraging W. .er Users (EWU) sub-project. In all, nine studies were conducted, out of which three studies were conducted in the Balochistan, two in the NWFP, two in the Sindh, and two in the Punjab provinces of Pakistan. Two studies in Sindh and one in Punjab have addressed the efficacy of WUA in the canal command area whereas one study in Punjab looks into potency of water user association for small dams operations in Barani (rainfed) area. Three studies in Balochistan are made on the management of karezes and tubewells in Baloch, Pashtoon and Syed tribal/family structure. Two studies on water users associations involvement in Northern Areas have pondered upon the collaborative water management systems in Swat and Chitral valleys respectively. Each study is briefly discussed in the following paragraphs:

Patterns of Management & Cooperation on Karez System in Balochistan (By Ghulam Nabi Achakzai, and Abdus Salam Toor)

This study has been conducted in the Pashtoon Area of Pishin District and in the Baloch Area of Kalat District where karez irrigation system was in operation since centuries. The old traditions such as the sense of common property, inter-dependence of shareholders, and principle of equality in karez matters had kept the system intact and functional. Then these noble, interwoven [illegible]cial ties started breaking. The influential shareholders were not paying d[illegible]tion in karez management; rather they were taking more than their r[illegible]share of water. Consequently small shareholders became dissatisfi[illegible] with the distribution system and less interested in collaborative works. Besides, the installation of tubewells have been reported to reduce flow to the karezes and create water shortage problems, felt more seriously by small shareholders.

The researchers have opined that the climatic changes, difficult maintenance of karezes, vested interest of big shareholders, and introduction of tubewell technology have been instrumental in deteriorating the old community-based irrigation system. No formal WUA has been formed on any of the karezes, however the idea has been favored by the interest groups in anticipation of the technical, etc. benefits.

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A Comparative Study of Karez and Tubewell Irrigation Systems in Balochistan (By Shukurallah Khan, Syed Arif, and Bahadur Khan)

This study has been conducted in Pathan area of Loralai, Baloch area of Mustung, and in Kirani Village inhabited by Syeds. It compares the socioeconomics of the old irrigation system based on karezes and the new irrigation system based on tubewells. It tries to find the reasons for the old system's deterioration which had been successfully for centuries.

Because the meteorological record on precipitation for more than six decades did not register any significant change in rainfall and snowfall, the investigators quite disagree with arguments given in the previous study that climatic change caused the karez system to decline. By and large, landowner preference in descending order for tubewells, dugwells, and then karezes was noted. Besides, the high maintenance cost on karezes and lack of big landholders' interest created favorable conditions for adoption of tubewell technology. However, economic conditions of small shareholders needed to be overcome through financial institutes.

The shift from karez to tubewell irrigation has made a social and economic impact on the society. As more big landholders adopt tubewell irrigation, the small shareholders got more land on tenancy over tubewell system. Thus farming changed from owner cultivation to the tenant or sharecropping system. The small shareholders also adopted and managed the karez system successfully in the past and still were willing to adhere to that irrigation system but they did not have resources. Therefore, tubewells should be installed at the mother well of a karez so that the small shareholders might also benefit from tubewell technology.

Irrigation and Land Use in the Kech Valley, Makran (By Fazal Karim Khan, and M. Nawaz)

This study is conducted in the Kech Valley of Makran Division. It acknowledges that fluctuation in karez flow due to rainfall variations was offset by better management and maintenance of karezes. For proper karez operation, regular cleaning and maintenance every year is required, but the task was done once every three or four years because of the prohibitive high maintenance cost. Since the small shareholders were not able to realize handsome returns from their crops, they were reluctant to share the cost for annual maintenance. This situation was further deteriorated by the council of the shareholders which, being a supreme body, rarely met. The big landholders were the water managers who usually handled all matters to their own benefit with no interest for small shareholders.

The researchers have denied any adverse impact of tubewells on the karezes. They observed such cases where karezes were dried even before a tubewell was installed or, in some cases, no tubewell was available in the neighborhood. In the past, the traditional system of karezes had remained a popular irrigation method for the fertile valley lands. Recently, tubewells were being installed for better and firm supply of irrigation water. Though tubewell irrigation has brought positive changes in the agricultural/cropping pattern after a passage of more than three decades they still were not popular in the area. The community continued to rely on karez irrigation which was being managed, maintained and operated collectively according to the local customs and norms.

Socio-Economics of Irrigation in Swat Valley
(By Usman Ali)

The researcher divided Swat Valley into plains, inter-mountain plains, and high mountain regions. He observed that Swat plains were not short of water. The maintenance and management of available water was done on communal basis where Jirga (tribal council) was invoked to decide the nature of maintenance and farmer participation according to share in the water.

The inter-mountain basin of Swat experiences water shortages in the summer. Therefore, the rotational system of water distribution has been adopted. Due to water shortages, conflicts were common and were settled by the Jirga. Management and maintenance of the diversion structure and the channel were organized by the community.

Due to severe winters, irrigation in the high mountain region was required only to grow summer crops. Though water is abundant in that season, the tail enders were getting water during night hours. The management and maintenance of irrigation system was done on communal basis.

All three systems are traditional and community-based where necessary works for restoration of channels and those of emergent nature were accomplished collectively. The informal participation of the entire community for the management of irrigation system was a legacy of good old traditions. Since such traditions were being vanquished by new advances in the irrigation and planning, new problems of dissociation have emerged out. These new problems need solved at their onset otherwise they will increase manyfold, disturbing the whole irrigation system of the area.

Irrigation and Society in Chitral District
(By Israr-ud-Din)

The researcher studied the response of society to irrigation in Khot, Kosht and Singur valleys of Chitral. He correlated the successful development of irrigation system with the participation of the local people in channel construction, system operation, maintenance, repair and management. The irrigation system of Drosh valley was also studied because, due to an uninvolved society, chances of the irrigation system failing have surfaced.

The irrigation systems at the three sites were very old and were developed under the control of Chitral's former ruler. The controlling authority's positive role had contributed significantly to the development and operation of the successful irrigation system. However, in Drosh, the system taken over by the government faced many problems of management and maintenance due to poor linkages between system managers and users.

The investigators opined that farmers of the Khot, Kosht, and Singur valleys had vast experience in irrigation management and are quite capable of creating their own organizations without the umbrella of formal water users associations (WUA). However, such associations are required for Drosh region. It appears that investigators are very rigid in the definition of water users association. They did not recognize that people of Khot, Khost and Singur were united under a traditional association, and that the formation of

a registered water users association may help them qualify for technology transfer, and credit facilities.

The community commitment and participation in the three valleys of Chitral is a missing foundation stone in the irrigation systems of Indus basin described by Hai, Panhwar and Mirza.

Incentives and Disincentives to Effectively Organize Farmers in Response to Watercourse Improvement in Sindh
(By Akhtar A. Hai, and S. A. Hussaini Jagirdar)

This study represents the problems associated with on-farm water management under the auspices of water users association or without it in a canal command area. Data have been collected from Badin District of Sindh in order to evaluate the impact of water user association on watercourse management and rehabilitation works, and to sort out the roadblocks to forming viable water users association. Three watercourses, each at head, middle, and tail of an irrigation channel, were selected. These watercourses were rehabilitated by On-farm Water Management (OFWM) department of Sindh under the umbrella of water users association (WUA). To examine whether or not improved watercourses performed better than traditional ones, the results were compared with three unimproved watercourses outside the realm of WUAs. The researchers observed that the organizational design of the OFWM program failed to motivate the tail end users to participate in water management actively. The disputes regarding equitable water distribution could not be resolved without the intervention of the irrigation department. The general organizational pattern of formal WUA was not found different from that traditional system which prevailed prior to WUAs. In terms of cropping pattern and yields, lands irrigated under improved or traditional watercourse also did not differ from each other. In most cases big landlords at the watercourse received most of the benefits of rehabilitation work. As WUA was poorly structured, small landholders were discouraged from participating, especially at tail end of the watercourse.

The researchers have argued that because water was in abundance and it was cheap compared to the price of other production factors, it was misused, thus it became very scarce for crops. The researchers also observed that the majority of farmers were tenants but the tenurial arrangements were not favorable for any form of on-farm water management program and formation of water users association. Thus the perceived benefits of improved watercourses were not achieved because water users were not fully dedicated in the improvement programs.

An Investigation of Small Farmers' Responses to Programs of Watercourse Improvement in Sindh
(By Iqbal A. Panhwar, and Noor Ali Khoja)

This study was conducted in Nawab Shah, Sanghar and Mirpur Khas districts of Sindh. The researchers have selected three watercourses. One represented the traditional water management practices on unimproved water courses, while the second case was for rehabilitated watercourses, and the third one represented the community behavior during rehabilitation works of a watercourse. The water users involvement, particularly that of tenant, in the improvement program was minimal. Management and maintenance were poor due to the program officials' lack of interest. It has also been reported that

leaders and influential decision makers of the community were interested in the improvement of the system only on their lands, depriving the small landholders of their share of benefits. The prescribed procedures for sustainable water management system were usually violated.

Due to mismanagement and improper maintenance of water delivery system at farm level, the problem of waterlogging and salinity was reportedly increasing, thus decreasing the cropping area. On improved portions of watercourses, researchers noticed an increase in the crop intensity due to increased water supply. Though they made a water shortage supposition within the study area, the above two findings negate their interpretations. From the study, it can be inferred that on-farm water management has increased the availability of water for crop use, conversely the mismanagement and lack of maintenance on unimproved watercourses have caused waterlogging and salinity as well as shortage in the net supply of irrigation water.

Constraints in the Formation and Functioning of Water Users Associations in Punjab
(By Ashfaq Hussain Mirza, and Muhammad Anwar-ul-Haq)

This study was conducted at five locations viz. Faisalabad, Jhang, Toba Tek Singh, Chiniot and Jaranwala. While studying the constraints in the formation of water users association in Punjab, researchers have seen little improvement in watercourse maintenance whether it was carried out through a water users association or through a loose, informal system. Like Sindh, in the Punjab personal influence plays an important role in decision making, irrespective of the presence of a formally constituted water user association or not.

The lack of interest of irrigation officials hindered the betterment of water management programs. The farmers did not understand the real benefits of the water management program rather they considered it a vested interest of a few influential people, which further inhibiting the formation of a functional WUA. The level of farmer acceptance for the watercourse improvement through water users association was very small, though in their individual efforts most of them were actively involved in the watercourse maintenance and improvement activities and were providing labor and funds before the introduction of formal water users associations. Without even knowing the contents of the document, the majority of them have signed for watercourse improvement through water users associations.

The researchers report that the concept of water users association has gained acceptance and popularity where:

a) The quantity of available water for irrigation was inadequate.

b) The water was saline because there was no chance of having a tubewell.

They have suggested that an authority should be assigned to WUA by involving the village headman, local council member, and head of all significant brotherles in the executive committee of the WUA. Officials of irrigation department and OFWM be included as ex-officio members of the executive committee. The investigators recommend a multi-purpose role of WUA

with major focus on regulating the water supply to the members. They have also suggested shortening the watercourse length to the extent that farmers could be capable of handling it easily.

The Social Organization of Small Dam Irrigation in Barani Punjab (By Salahuddin A. Khan, Sarfraz H. Ansari, and Hafeez-ur-Rehman)

This research was conducted on Dungi Small Dam in Gujar Khan area. The researchers have examined the small dam irrigation procedures developed through state intervention in the rainfed region of Potohar. Small dams were rehabilitated through WUA in the area. The local bureaucracy appeared to be a big constraint against the formation of a viable water user association for management of small dam irrigation system. In this region, farmers were not only willing to form water users associations but were ready to take the responsibility of operation and maintenance of small dams.

The Dungi Dam Development Committee, headed by Assistant Commissioner, had made efforts to seek local participation in the planning and development of the system but did not succeed due to the adamant attitude of concerned irrigation officials. Consequently, the committee became defunct [illegible] of its inception. Investigators have reported that the irrigation structure existing at Dungi Dam was under design. It was working poorly because the system managers did not understand the systems structure and its operation. In order to acquire the optimum utilization of irrigation water from that system, the designs must be rechecked by qualified personnel, and local water users need to participate at planning and implementation stages. The poor management, maintenance and operation of the system have been attributed to the adamant distancing attitude of local bureaucracy of the Small Dam Organization; though the water users were willing to participate in the system operation, the local bureaucracy would not.

SYNTHESIS

These studies fall into three broad categories: large state managed canal network; indigenously developed small scale irrigation systems; and tubewell and karez systems.

Three studies in Balochistan clearly indicate that tubewells are replacing karezes because the latter have high maintenance costs. Though formal water users associations (WUA) are not formed to operate and manage karezes, the credit facilities and low cost technology for karez rehabilitation can bring farmers under the umbrella of WUA to practice economical farming. With the introduction of tubewell irrigation in Balochistan, the element of individual economic gain is breaking the traditional societal structure associated with the old karez irrigation system. The importance of economic returns is fully realized in the province whether or not the area is dominated by Balochs, Pashtoons or Syeds. Land tenancy is gradually emerging as a viable farming system over tubewell irrigation.

The irrigation systems in Swat and Chitral regions are also very old, and being operated and maintained successfully by the local people according to the local customs and norms. Whenever these systems are imprudently intervened, they face difficulties. In these two valleys also, formal WUA's do not exist though farmers are united under local leadership. If they were

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working under registered umbrella of WUA's, they might receive new technology and qualify for some credit facilities.

Though some water users associations are formed over the large irrigation systems of Indus Basin in the Punjab and Sindh provinces, no significant impact on water course rehabilitation and management programs has been noticed by the investigators. The mode of maintenance through formal water users associations does not differ from that of informal ones. Personal influence plays an important role in decision making whether or not a formal WUA was operating. The role of water management officials is not persuasive rather it is the influence of a few big landholders of the area. Because no significant economic gain has so far been realized through WUA, small farmers consider on-farm water management program a vested interest of a few big land owners. As a matter of fact, traditionalism and lack of education have made a wide gap between small tenants and big landholders. The conclusions drawn from EWU studies do not conform with the report of Enterprise and Development Consulting (Pvt) Limited (1992). It clearly appears that more time is required to make these organizations really functional. Out-reach programs and workshops may be conducted to educate the farmers, and credit facilities may be provided for other inputs through a registered water user association. If the commitment and participation of local farmers, as seen in the Swat and Chitral regions, is solicited in the Indus Basin irrigation system then there is a chance of sustainable farmer's organization for better water management.

In the small irrigation system of Barani areas in Punjab, the Small Dams are improperly designed. The maintenance and operation of these dams lack the attention of the Small Dam Organization. The farmers of the area see that they can manage the system better themselves. They express their willingness to participate in the operation and management of the system but the bureaucracy is hindering.

CONCLUSIONS

a) Water users association can be highly instrumental in watercourse rehabilitation and maintenance programs and in irrigation scheduling but a lot of persuasion and motivation is required for the farmers and land owners to make them participate in a formal water user association.

b) Due to the lack of education and unequitable distribution of irrigation water, small landholders are less interested in WUA programs. The uneducated farmers do not understand the real benefits of water management programs, rather they are considering it a vested interest of a few influentials.

c) In water scarce and in saline groundwater areas, farmers are more willing to form water users associations than those in fresh groundwater area.

d) Irrigation department officials and local bureaucracy are a big impediments to forming viable water user associations. For example, water users associations in Barani area are willing to undertake the operation and maintenance of small dams but local bureaucracy does not cooperate.

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e) The personal influence of decision makers in the society play an important role in the decision making of water management problems all over Pakistan. Some times big landholders impede successful water user association when they are violating the interests of small landholders.

f) In Balochistan, the karez system is being replaced by tubewells because its maintenance cost is much higher than tubewells. Shift from karez to tubewell irrigation has made a social and economic impact on society because tenancy system is replacing bigger landholders via small farming groups. However, in Makran, people are more accustomed to karez irrigation system.

g) Though seasonal fluctuations in precipitation tend to reduce recharges to the karezes, that effect could be offset by better management and maintenance of karezes.

h) Water users associations are not formed for operation and rehabilitation of karezes or tubewells though there is large scope in that area. Credit facilities should be provided to the water users associations for rehabilitation and maintenance works.

i) Irrigation system in Swat and Chitral operates by informal participation of the entire community. The farmers of these two valleys have vast experience in irrigation management and were quite capable of creating their own organization. However, water users associations are required to solve new problems related to water management at the onset otherwise they will destroy efficiency of entire irrigation system.

RECOMMENDATIONS

It is recommended that:

(a) more training workshops should be organized for farmers on the rehabilitated watercourse sites,
(b) the task of collaborative drainage should be included in the charter of water users associations,
(c) all credit facilities for farm machinery and inputs, and for rehabilitation of water courses, karezes and tubewells should not be provided unless farmers have constituted a water user association,
(d) an equitable distribution of water for tail enders as well as for small landholders should be ensured through WUA where the role of a tenant should be appropriately acknowledged,
(e) the PCRWR should embark on action research programs by involving farmers in the planning of its end-user oriented research and development activities.

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