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*Research Report*

# Institutional Change and Shared Management of Water Resources in Large Canal Systems: Results of an Action Research Program in Pakistan

*D. J. Bandaragoda*

International Water Management Institute

**Research Reports**

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# Contents

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# Summary

An action research program conducted at four pilot sites in Pakistan found that organizing water users at the secondary level of Pakistan's contiguous canal irrigation system was socially feasible. This was contrary to the popular beliefs that existed both within and outside Pakistan. The popular notions, which were related to constraints of an integrated socio-technical system, illiterate farmers, social pressure from big landowners and obstacles caused by the hierarchical society, were proven to be invalid under conditions of a participatory process of social organization. The methodology used was characterized by a step-wise process of social organization, which was catalyzed by a locally recruited small field team with the assistance of community-based social organization volunteers. Training and other forms of capacity building were the major motivating influences. A field implementation coordination committee consisting of representatives of all service delivery agencies working in the area, along with selected water users, highlighted the necessity of farmer-agency coordination, and greatly facilitated an incentive mechanism through collaborative activities. This combined effort resulted in successfully achieving the formation of two hundred water user associations (WUAs) at the tertiary (watercourse) level, and four water user federations (WUFs) at the secondary canal (distributary) level at the four pilot sites.

The suggested institutional framework for sharing responsibility for water resources management in large canal systems is a combination of property rights regimes. Notably, the newly introduced element to this framework is the conversion of the existing state-property regime at the secondary canal level to a common-property regime. This change will involve the common-property regime at the secondary canal level to have interactions with the state for water delivery in the main canal and with a private-property regime at the tertiary level for appropriation of water resources units.

The emerging results of this social experiment are encouraging. The new WUFs were able to take collective decisions to negotiate with state irrigation authorities on joint management agreements for managing water resources in the canal system. Although these agreements were not made immediately effective due to a procedural difficulty imposed by the present legal framework, the WUFs proceeded to test their capacity in undertaking a planned maintenance program during the canal closure period, and also to initiate a maintenance-related infrastructure improvement program. Replicability of this social organization program is enhanced by the methodology adopted: the deployment of small field teams and the use of local volunteers. The step-wise social organization process enhances sustainability. One drawback, however, has been the lack of full commitment from the related government agencies, which have to take the initiative for empowering the water user organizations. Both the enthusiasm and the capacity demonstrated by the water users in social organization for collective action show a good potential for further progress. Very likely, the demand generated at the local level could facilitate a process of bureaucratic reorientation, which in turn would provide the necessary institutional support for the new water user organizations (WUOs).

This report presents the conceptual and methodological framework underlying the action research effort. It has been validated in the context of a social environment that is characterized by a hierarchical society with a low literacy rate, but with a tremendous enthusiasm to absorb new technology and gain higher productivity.

# *Institutional Change and Shared Management of Water Resources in Large Canal Systems: Results of an Action Research Program in Pakistan*

*D. J. Bandaragoda*

## Introduction

This report is based on the results of an action research program in Pakistan conducted by the International Water Management Institute (IWMI). An analysis of empirical data is presented in the light of existing theoretical knowledge on collective action for natural resources management. The report also highlights the current constraints associated with a wider application of some of these findings, which reflect the difficulties in pursuing large-scale institutional reforms in the rural sector of developing countries. Finally, the report raises some key research issues that need to be explored further.

The action research program was based on three main propositions, which were deviations from conventional wisdom. First, it assumed that "farmers can manage," which is a marked deviation from the popular notion, particularly among government officials, that the farmers in this region are mostly illiterate and incapable of undertaking management responsibilities for operating large canal irrigation systems (Haq and Shahid 1997). Second, in contrast to the current institutional strategies that normally emphasize a relatively narrow objective of reducing government costs in managing irrigation infrastructure, the action research program aimed at broader resource management goals. Third, the action research also sought to identify a demand-driven bottom-up approach in establishing mechanisms for decentralized management of water resources. This strategy was expected to address the issue of increasing disappointment with the impact of the usual top-down approaches for organizing water users and transferring management responsibilities (Zaman and Bandaragoda 1996; Vermillion and Garcés-Restrepo 1998; Kikuchi, Fujita, and Hayami 1999; Samad and Vermillion 1999; and Samad and Smidt 1999).

The main objective of this action research was to test, through pilot efforts, the viability of farmers organizations for managing parts of the water resources systems so that more efficient and equitable use of water can be achieved in a hierarchical society such as in Pakistan. To achieve this objective, the action research conducted a number of field activities in a participatory manner. In the given context of large-size canal systems, and the deep-rooted social perceptions regarding the role of the state as a benefactor and that of the water users as the beneficiaries, the strategy of working towards shared management was found to be very productive. To both the state agencies and the water users, the idea of a complete management transfer to the user organizations at this stage was not readily acceptable. The action research program concluded that a property-rights basis for possible joint management arrangements is a conceptually sound strategy to pursue in these circumstances.

This action research program coincided with a policy resolve in Pakistan and several other countries in the region to introduce major reforms aimed at improving the effectiveness of water resources management institutions. The report

focuses on the process of organizing water users in the context of responses of the main actors involved in water resources management to changes being proposed and introduced in Pakistan. The contextual background in which the action research has been designed is summarized in the appendix. The report presents the new methods adopted in this action research, and a discussion on some emerging results.

## Objectives and Assumptions

### *Action Research Design*

The action research program, which was designed on the basis of the historical and contextual background outlined in the appendix, sought to answer the following research questions:

1. Can effective WUOs be established in the given socioeconomic and technical contexts?

2. Can the capacity of the WUO members in the pilot sites be improved for taking collective choice decisions and actions related to improved water resources management for irrigated agriculture? and

3. Can these WUOs and state irrigation-related agencies agree on their roles and functions in a situation in which WUOs decide to undertake secondary canal-level water resources management on the basis of joint management agreements between irrigation authorities and themselves?

The broad conceptual approach underlying the action research included some assumptions in the form of specific expectations for the future progress of participatory management in Pakistan's irrigation canal system. These expectations were:

- that the WUOs would have a well-defined right to the water and authority over its use, and eventually be accountable for the water received at the head of distributary canals

- that the WUOs would be responsible for distribution of water among the member water user associations (WUAs) at the watercourse level according to their own agreed allocation rules

- that the WUOs and their member WUAs would be ready to be responsible for managing groundwater levels in their respective command areas

- that the WUOs would reach an agreement with their members, as well as with the agencies, for assessment and collection of appropriate water charges and/or operation and maintenance (O&M) costs of irrigation and drainage facilities in their distributary command areas

- that they would undertake the collection of water/drainage charges, improve water management practices, and carry out other activities related to the use and disposal of irrigation water, including the maintenance of irrigation and drainage facilities

- that the government would introduce proposed institutional changes in the form of semiautonomous Provincial Irrigation and Drainage Authorities (PIDAs) in the four provinces, and Area Water Boards (AWBs) at

the main canal level, at least on a pilot-scale initially

- that these PIDAs and AWBs would provide the necessary institutional support to the newly established WUOs, and together, they would form an improved institutional framework for irrigated agriculture in Pakistan

To realize these expectations, the project design further anticipated that the WUOs would be able to develop and enforce appropriate internal bylaws, which would be binding on their members, and resolve any water-related disputes that may arise among them. It was envisaged that some "social engineering" by the social organizers would be able to catalyze this process so that the WUOs and their members would agree upon a set of rules, rights, and responsibilities.

During initial interactions with agency staff and farmers, several other assumptions were also made. The main items were:

- that the operating agencies would be ready to empower the new pilot WUOs and cooperate with them to ensure uninterrupted water supplies and O&M of the physical systems (the requirement for government agencies' commitment in this regard was not reflected in any of the project documents)

- that the government would assist the new WUOs to enforce their internal rules by providing them with an adequate enabling legal environment

- that the individual water users would derive some economic gain out of being organized for taking over additional responsibility (farmers often question the potential of individual economic gain from collective action)

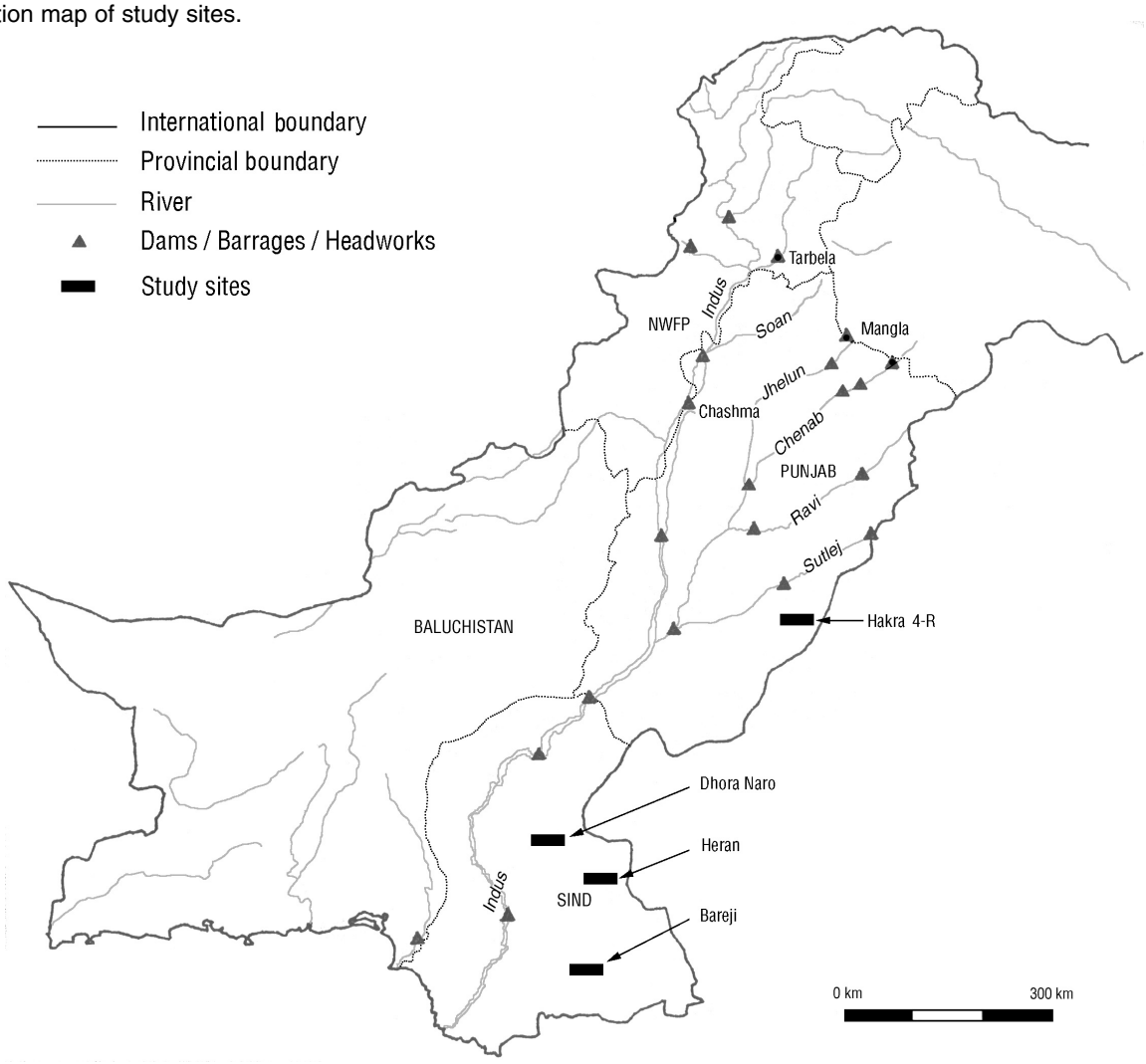
- that the organized farmers could cope with the existing social pressure and political and feudalistic forces, and collectively act to improve equity in water distribution

## *Selection of Pilot Sites*

In many action research efforts, a contentious issue is the representativeness of the selected pilot sites. Given the project-related constraints on choice, an assumption was made that consideration of a few important criteria, such as design discharge, canal length, number of outlets and command area, distribution of water users in terms of landholding size, and location of the secondary canal along the main canal, would lead to a reasonably representative choice of pilot sites.

As this action research program was based on donor initiatives in two major infrastructure development projects, the study sites had to be necessarily located in those two project areas. In the Punjab Province, the study had to be limited to one site within the World Bank-funded Fordwah Eastern Sadiqia (South) Irrigation and Drainage Project area, and in consultation with irrigation-related agencies, the Hakra 4-R Distributary was selected as the pilot site. In the Sindh Province, three sites were selected from the Left Bank Outfall Drain (LBOD) project area, one from each of the three "LBOD districts:" Bareji Distributary in Mirpukhas, Dhoro Naro Minor in Nawabshah, and Heran Distributary in Sanghar. In this instance, the process of site selection was designed during the study inception to ensure a fairly representative selection, given the restriction of the number of sites to three, and accordingly, the sites were selected in a participatory manner, involving both the operating agencies and the water users. Locations of the four distributary canal sites are shown in figure 1. The main physical and socioeconomic characteristics of Pakistan's irrigation outlined in the appendix are commonly applicable to all of these selected pilot sites.

FIGURE 1.
Location map of study sites.




## Concepts Underlying a New Approach

### *Broader Outlook*

The action research was based on the proposition that a broader focus on water resources management for irrigated agriculture, rather than the usual narrow focus on irrigation system management, would prove appropriate for effectively organizing water users.

Many donor-related projects and government interventions for investment in irrigation tend to emphasize two main management responsibilities: system operation and system maintenance. Guided by such emphasis, developing-country irrigation agencies are mostly concerned with operating and maintaining the "irrigation schemes," rather than with managing water as a resource. The rare occasions of conducting performance studies using performance indicators are also limited to evaluating the "behavior" of physical systems. Recently introduced concepts and

strategies of "participatory irrigation management" also retain this narrower focus on system management. Popular participation is often believed to be a strategy primarily aimed at increasing the probability of establishing infrastructure that people want, in ways people can and will manage them (Meinzen-Dick, Reindinger, and Manzardo 1995).

In this perception, the major benefits from users' participation through collective action are presented as increasing the potential for better maintenance of physical facilities and reducing the financial and management burdens of the governments. A number of countries adopted this proposition (Turral 1995). Pakistan's experience (see appendix) shows that developing-country governments usually tend to be content with satisfying donor pressure on these preferred emphases, whereas the donors also perceive the countries' fiscal and management constraints as their major motivating factors for change. A common perception is that "governments are finding that by involving strong water users associations in project management and fee collection at the local level, they can use the capacity of community members to exert social pressure on their neighbors to pay" (World Bank 1993:57).

Initial interactions with farmers indicated that these apparently extractive and restrictive objectives would not encourage water users to work towards social organization for participatory management. The need to improve fee collection among them, or the need to reduce government expenditures, would not readily motivate individual water users to participate in collective actions or joint organizations. In contrast, the broader notion of improved management of water resources available for agriculture was more readily acceptable to the farmers who were looking for increased productivity in agricultural pursuits.

The broader objective of managing water resources for agriculture has a wider connotation, which transcends the boundaries of "irrigation system management." First, it encourages thinking about water as a resource, which is distributed among, or appropriated by, a competing group of users within integrated water resource systems (Keller, Keller, and Seckler 1996). Second, it compels the individuals to be concerned about the sustainability of water resource use in the long term. Third, it alludes to a socioeconomic impact associated with the use of water as an important input for a production process. Also, the water user is encouraged to think of water saving, water disposal, and water-related environmental issues.

## *A Property-Rights Perspective*

The attempt to broaden the traditional focus of organizing water users and transcend beyond the physical system was compatible with another concept included in the action research, the property-rights perspective of shared management in large canal systems. Whenever a water resources system is jointly owned, it can be treated as a common pool resource,[1] out of which an individual consumer or appropriator would obtain resource units in such a way that each bundle of resource units consumed is subtracted from the pool of resources, and is not available to other consumers. Scheumann (1997:34) illustrates how common pool resource systems can be held under four different property-rights regimes, and the circumstances under which overuse can occur, and when it can be avoided. On the basis of this explanation, water resources systems can also be held by the following four categories of property rights:

[1]A concise definition of the term "common pool resources" (CPRs) given by Ostrom (1992) is helpful to understand the dynamics of a property-rights regime. CPRs are "natural and man-made resources sufficiently large that it is costly to exclude users from obtaining subtractable resource units." A distinction is also made between the flow of resource units and the resource system producing the flow. While subtractability is a characteristic of the resource unit appropriated from a CPR, the jointness of use is a characteristic of the resource system.

Private Property (e.g., private tube well, *warabandi*[2] turn in a watercourse)

- Exclusion of consumers can be easily applied.
- Resource allocation can be efficiently effected.

State Property (e.g., main, branch, and distributary canal water)

- Relatively high cost of exclusion can lead to free riding.
- Noncooperation of consumers is common.
- Susceptible to overuse.

Common Property (e.g., village pond, farmer-managed irrigation system)

- Exclusion is possible.
- Cooperation by consumers can be achieved.
- Resource allocation can be made efficient.

Open Access (e.g., unsupervised lake or large canal)

- Non-exclusion is the norm.
- Cooperation by consumers is not needed, or difficult to achieve.
- Overuse is most likely to occur.

The main features indicated for each category are specifically applicable to property rights related to water resources systems. Of these four forms of property rights, common property appears to be the most applicable form to a common pool of water in a canal system, from which resource units are extracted by individuals on the basis of an agreed system of rules. Common property refers to situations where there is "tacit cooperation by individual users according to a complex set of rules specifying rights of joint use" (Runge 1992:18).

On this basis, a canal irrigation system, in which a time-based water turn rotation (warabandi) among the individual water users is in operation at the tertiary level, can be analyzed in terms of the above categorization:

- The tertiary level watercourse is a combination of common and private property rights. The physical system is common property as it belongs to the whole group of water users in the watercourse command area, whereas, the water flowing at a given time in the watercourse is private property as it belongs to one water user who is having the warabandi turn at the time.

- The secondary level distributary canal and the primary level main canal, including both the water flowing in them and their physical facilities, are state property.

Some would assert that common property arrangements in developing-countries failed due to overuse or misuse, and eventual degradation of resources. As a remedy, private property regimes were imposed to replace common property arrangements. However, these changes also failed to stop the overuse of resources and even resulted in "increased inequity in already unequal distribution of wealth" (Runge 1992). In Pakistan, both state and private property regimes over water resources have clearly failed in efficient and equitable water resources management. The former case can be seen in the way distributary canal subsystems are managed allowing for rampant "free riding" (Mirza

[2]Warabandi is a time-based rotational method, which is designed to achieve equitable distribution of water available for a watercourse. The rotation is by water turns fixed according to a predetermined schedule specifying the day, time, and duration of supply to each irrigator in proportion to the size of the irrigator's landholding (Bandaragoda and Rehman 1995). For each watercourse, there is a warabandi list giving the names of actual water users taking water from the sanctioned farm outlets along the watercourse, and the corresponding time turns allocated to each water user.

1989:15), whereas, the latter is well illustrated by the overuse of groundwater resources through private tube wells (Meinzen-Dick 1996). The hypothesis is that a well-coordinated effort through a common property regime in either of these cases can arrest the inequitable distribution and overexploitation trends (Bromley 1992; Ostrom 1990).

## Contextually Appropriate Methodologies

Many people, both within and outside the country, asserted that organizing water users for distributary level management in Pakistan was a very difficult task; some believed that it was impossible (Nasir 1992). Most of the contextual factors described in the earlier sections of this report contributed to this perception. Preliminary field investigations also indicated that organizing water users at the distributary level posed substantial problems. Only some of the watercourses in the pilot area had experienced the formation of WUAs sponsored by the On-Farm Water Management Program, and these WUAs were already defunct. The water users in these watercourses were particularly hostile to the idea of yet another attempt to "organize" them. People in the area appeared to be overwhelmed by problems of salinity and unproductive farming, and showed little patience to explore possible long-term solutions. Specially designed social organization methodologies were helpful in this context.

The given social context demanded a fairly cautious and slow process of social organization, carefully designed with adequate trust-building strategies, whereas, the physical context of the large contiguous canal irrigation system called for designing a method of appropriately sharing the management responsibility. Based on these two main requirements, four special methodological features emerged in this action research: 1) deployment of small social organization field teams consisting of persons with a strong local background; 2) use of community-based volunteers; 3) nondependence on externally funded physical improvements as an incentive; and 4) a step-wise social organization process.

### *Locally Recruited Small Field Teams as Catalysts*

The preliminary stages of the action research program found that a community that is normally suspicious about outsiders, strangers, and new ideas, preferred to listen to local opinion leaders. The project staff who were directly involved in field activities were all locally recruited, and were able to break this barrier of mistrust.

Two other characteristics of the field teams helped in this process. The field team at each pilot site was kept at a minimum size of five, with a combination of a formal training background in social science and agricultural engineering. The disciplinary combination helped in handling the strong socio-technical linkage that characterizes water resources management for irrigated agriculture, whereas, the small-size field teams were successful in maintaining close interactions with the community. The small size of the team also meant easy replicability of the catalytic effort on a wider scale.

The training given to the Social Organization Field Teams[3] on project objectives and methodologies became an asset when they had to

[3]The term "SOFTware" was coined by IWMI's staff in the Hakra 4-R Distributary pilot project in Punjab to distinguish these Social Organization Field Teams from IWMI's other teams engaged in more technical work. More details of the organization process are given in Bandaragoda et al. 1997.

reflect the special features of the project design in their field work. A fair understanding of the institutional implications of irrigated agriculture was considered important in motivating people to see the value of social organization. This training also helped the staff in undertaking self-assessment of their field operations and collective action.

### *Community-Based Social Organization Volunteers*

To supplement the small field teams, a strategy was adopted to use community-based volunteers in social organization work. Initially, the project decided to call these volunteers "contact farmers" because they had to play a pivotal role as a contact between the field teams and the community. Selecting some suitable persons from the local community to be deployed as "contact farmers" was an important strategy in the social organization process. The term "contact farmers" was found to be associated with the "influentials," big landowners and farmer leaders of the Training and Visit (T&V) system adopted by the Agricultural Extension Directorate. Since the farmers in the study areas showed little appreciation of the use of these elitist "contact farmers" in the T&V system, and as their contribution had not resulted in the proper functioning of the T&V system, the term had an unfavorable connotation. In order to avoid farmers' mistrust from the start, the term "contact farmers" was replaced by the term "Social Organization Volunteers" (SOVs).

### *Training as a Motivating Influence*

Experience of many infrastructure development programs in Pakistan (Byrnes 1992) supported the idea of "putting people first" (Cernea 1985). During the reconnaissance surveys in the pilot project area, many water users inquired about the package of physical incentives planned for the project. They were accustomed to the government subsidies on watercourse lining and tube-well development, etc. A considerable effort was spent to convince the water users of the need to get organized first so that a form of collective action could benefit more from whatever the government could deliver, or from their own resource mobilization initiatives. They were eventually convinced of this approach towards self-reliance.

The project did not have access to funds allocated for any physical improvements to be effected in the pilot sites. This was a major deviation from the usual social organization project designs adopted earlier in Pakistan and elsewhere in the region. Both On-Farm Water Management and Command Water Management programs had physical improvements as the main task, and the associated institutional development component was to enable this primary task. Consequently, both programs could not achieve any meaningful results from the second objective (Byrnes 1992; World Bank 1996; Zaman and Bandaragoda 1996). Instead of physical incentives, this action research program planned to use training as an incentive for organizational interactions. The participatory approach adopted throughout the project period typically suited this strategy, and a series of training programs and similar interaction programs were helpful in maintaining a steady level of enthusiasm among the water users.

The motivational effort, through training and information sharing, was also to engage the water users in building awareness, confidence, and mutual trust. There were no monetary incentives and no promises of physical assets. The training inputs were incorporated into other social organization activities, while monitoring the effect of each step and building on it. The strategy was also to share project-related information with the water users in frequent meetings with small and large groups, in places considered as "neutral," such as schools, mosques, playgrounds, and other community meeting places. Water users showed a greater interest in learning about the physical aspects of the irrigation and drainage

systems than about proposed organizations. This was quite natural as the physical subsystem of an irrigation system would be foremost in the minds of the people. They liked to hear about quantity and quality of water they received, sedimentation in their canal system, and the conditions of the structures. They were also keen to know about new crop varieties, agricultural inputs, and modern cultivation methods for conserving water.

## *Phased Social Organization Process*

Experiences in other countries suggested that "getting the process right" (Uphoff 1986) was a valuable initial investment in social organization work. An attempt was made, therefore, to develop an appropriate process before embarking on the actual field work in the pilot project. A four-phase organizational development process[4] was used as a guide during action research implementation. The four phases of this process are:

- support mobilization
- initial organization
- organization consolidation
- organizational action

The support mobilization phase was a "get-set" stage during which the field teams were mobilized and trained, initial collaborative arrangements were discussed with the staff of On-Farm Water Management Directorate of the Provincial Agriculture Department, Provincial Irrigation Department and other irrigation-related agencies, selection of the pilot sites was finalized, members for a field-level coordination committee were identified, and initial baseline information was collected.

In the second phase (initial organization phase), some progressively advancing steps in interacting with the community were taken. The core social organization field activity was implemented during this phase. Starting from a familiarization program, the field teams and the social organization volunteers proceeded through three other series of interactions, and finally reached the culminating step of forming the water user federations.

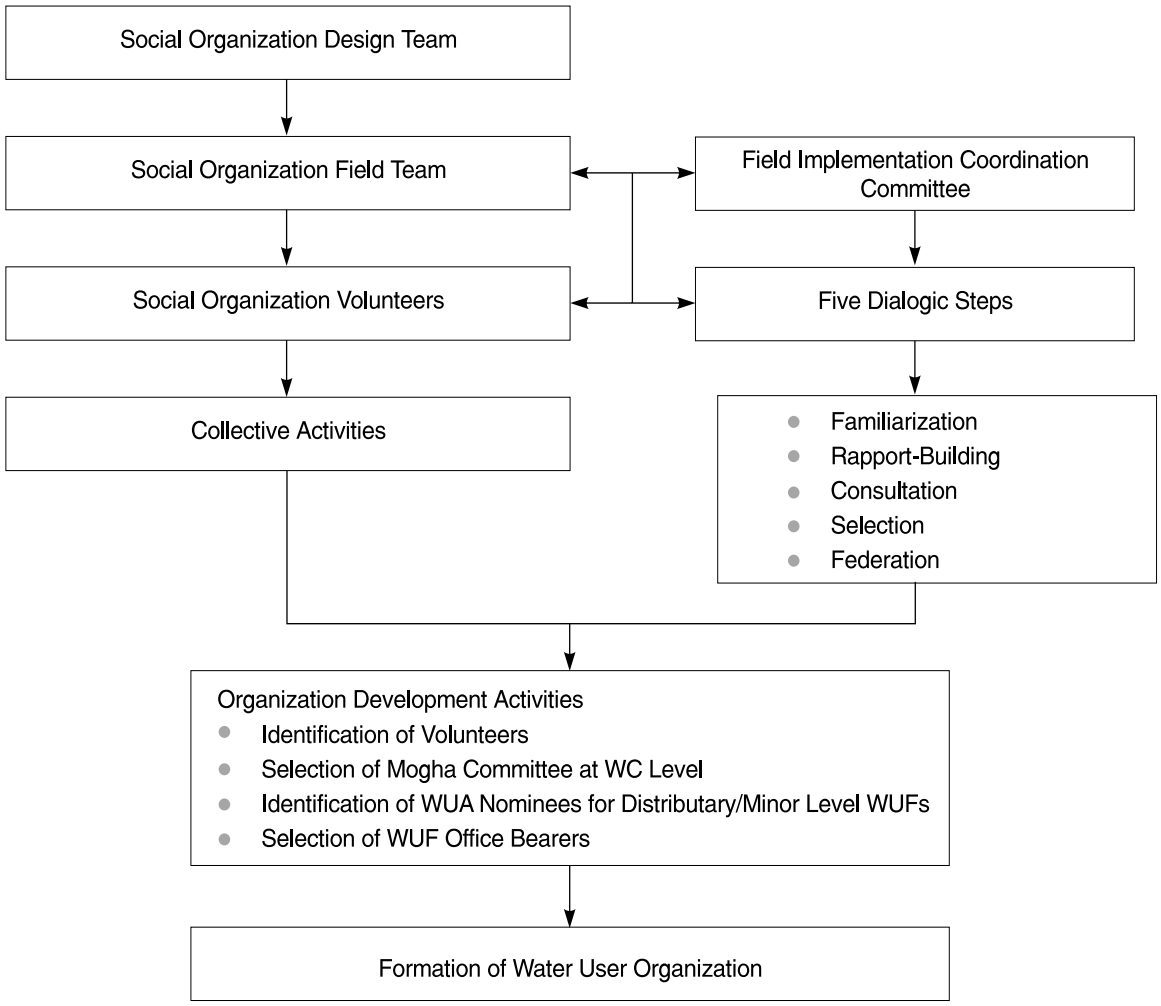
The organizational consolidation phase included a series of capacity-building programs to provide WUO leaders and their members with the necessary knowledge and skills to engage in actual water resources management tasks. Registration of WUOs with the On-Farm Water Management Directorate under the Water Users Ordinance, and the preparation of joint management agreements (JMAs) between the distributary level water user federations and the Provincial Irrigation Department were two important tasks undertaken during this phase. The last phase is meant to give effect to the provisions of the joint management agreements.

In this organizational development process, many actors would need to contribute. A design team coordinated the planning effort, and collaborated with the social organization field team located in the three pilot sites. The selected SOVs and a Field Implementation Coordination Committee (FICC) were the other partners in the field. The FICC consisted of representatives from various agencies providing irrigated agriculture services to the farmers, including the civil administration, and selected farmer representatives. Social organization activities were supported by some collaborative activities by various agencies. The idea of conducting collaborative activities was to maintain the water users' interest on the action research program. A facilitator, such as IWMI, would play the role of a catalyst in bringing various line agencies and other service delivery groups to the water users on their request.

The overall process described above is depicted in figure 2.

[4]This four-phase process for water user organization activities in Pakistan was adapted from the Maintenance and Operation (M&O) guidelines provided by Skogerboe, Poudyal, and Shrestha (1993).

FIGURE 2.
Social organization process.



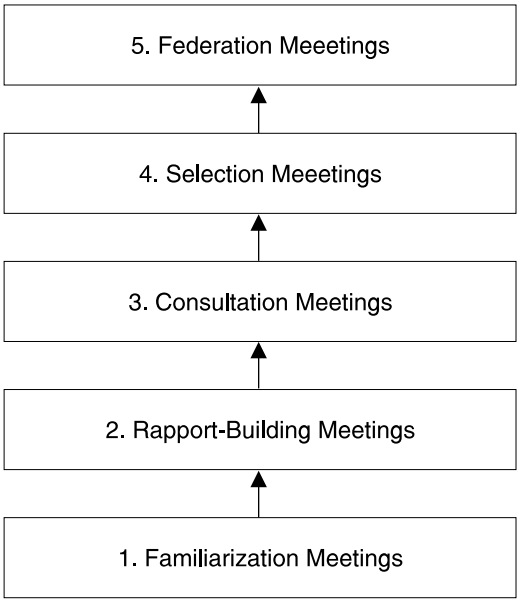

## *Five Dialogic Steps*

An important feature of the iterative process was the progressively enhanced interactions in a series of meetings with the water users, which culminated in forming water user federations in the pilot areas. Adopting a step-wise approach, and building on the steps already taken, the process advances towards the group behaving on mutual trust, sharing information, consulting for consensus, developing options, and implementing an appropriate organizational design. Since the interactions were between the catalysts and the water users in the form of dialogues,[5] the stages of this iterative process of social organization were named "Five Dialogic Steps" as indicated in figure 3 below.

First Dialogue: A series of "familiarization meetings" to get to know the area and the people in general, and to introduce the purpose of the field team's visit, the idea of the pilot project, and its proposed activities to any person met in the command areas.

[5]For characteristics of dialogical communication, see Schrijvers 1995:24.

FIGURE 3.
Five dialogic steps leading to the formation of a water user federation.




Second Dialogue: A series of "rapport-building meetings" to meet with the identified SOVs and a few other water users in small groups. The main purpose was to explain the objectives, status, and programs of IWMI and build up fellowship with the SOVs and their colleagues.

Third Dialogue: A series of "consultation meetings" to consult as many water users as possible for developing tentative plans for establishing water user organizations. The meetings were to be in groups larger than those considered for "rapport-building" meetings. These consultation or planning meetings formed a crucial step in the social organization process to ensure that the water users knew the project objectives clearly, and to follow up on earlier rapport-building meetings for clarifying any misunderstandings among the people regarding the program.

Fourth Dialogue: A series of "selection meetings" for the purpose of discussing the process for selecting or electing organizational leaders at the primary (watercourse) level. After clarifying the elements of a democratic method for this purpose, meetings were held for each watercourse to select the organizational leaders. With wide publicity and extensive personal interactions, an attempt was made to get the maximum number of water users in each watercourse to participate.

Fifth Dialogue: "federation meetings" to initiate the identification of office bearers for the pilot water user federations. During these interactions, the water users were encouraged to select the watercourse nominees, who would form the general body of the federation in each pilot area, and then proceed towards selecting the WUF leaders.

## Results and Discussion

### *Deployment of Community-Based Volunteers*

The most difficult part of this action research program was to gain entry into the community of water users. Through the first dialogic step of familiarization meetings, a group of community-based volunteers was selected to facilitate this initial entry and the subsequent social organization process. At Hakra 4-R Distributary site in Punjab, the field teams interacted with 486 individual water users, and, on the basis of their recommendations, selected 158 SOVs. With a similar effort, 160 SOVs were selected for the three pilot sites (Bareji, Dhoro Naro, and Heran distributaries) in the Sindh Province. Table 1 gives some important characteristics of the selected SOVs, as compared with the primary groups from which they were selected.

TABLE 1.
Comparison of some socioeconomic characteristics of SOVs and primary group of water users.

| Item | H-4R | | Bareji Distributary | | Dhoro Naro Minor | | Heran Distributary | |
|---|---|---|---|---|---|---|---|---|
| | All* | SOVs | All | SOVs | All | SOVs | All | SOVs |
| Total number (n) | 3,494 | 158 | 354 | 48 | 504 | 50 | 718 | 62 |
| Nonoperator landowners—as % of n | 9 | 0 | 50 | 62 | 10 | 58 | 47 | 74 |
| Owner-operators—as % of n | 85 | 99 | 44 | 17 | 33 | 20 | 40 | 24 |
| Tenants—as % of n | 6 | 1 | 6 | 21 | 57 | 22 | 13 | 2 |
| Literacy rate as % of n | 38 | 76 | 28 | 83 | 33 | 66 | 46 | 90 |
| >10 years' education | 5 | 45 | 4 | 23 | 2 | 24 | 27 | 44 |

*All = All water users.

*Sources:* Cheema, Mirza, Hassan, and Bandaragoda 1997; Memon, Hassan, and Bandaragoda 1997; Hassan, Mirza, and Bandaragoda 1996; Bandaragoda and Memon 1997.

The action research design expected to select SOVs from community members who were adequately informed about the community and its needs, prepared to assist the action research process, and showing an ability to play a very useful and active role in building trust among the people. This initial assumption was found to be correct. As expected, the selected SOVs knew (and were known to) the people fairly intimately, and the criteria of education and knowledge about the community superseded other features such as landownership, tenurial status, and age. The SOVs, being all based in the community, were able to share the community's language, beliefs, traditions, and rituals, and were well aware of their common needs and problems, and became an accepted group of opinion leaders.

Table 1 shows that the tenurial pattern in each pilot site is reflected in the selection of SOVs. In Hakra 4-R Distributary of Punjab, the majority of the water users are the owner-operators, whereas, in the three Sindh sites, there are a considerable number of nonoperator landowners, who employ agricultural labor or tenants in operating their landholdings.

The methodology of using local volunteers had the following advantages:

- Interventions could be routed through local people, causing little room for mistrust; and the SOVs in turn could encourage a local initiative.

- The SOVs could reach the community in the large pilot distributary command area fairly quickly, partially overcoming the project's time constraint.

- As SOVs were deployed on a voluntary basis, the method was more cost-effective than in engaging paid agency staff and could easily be applied on a wider scale.

The greatest impact of the SOV's contribution was felt when they took upon themselves to explain to the community the objectives of the project at a very critical stage of the project. At the early stages of the fieldwork program, social organization activities related to farmer participation in management were seen by some people, who had a vested interest in retaining the status quo, as part of a hidden agenda sponsored globally by aid agencies and countries more closely associated with them. The action research project was seen as an alien effort exerted to achieve conspiratory objectives detrimental to

Pakistan. At this stage, only the SOVs' voluntary actions helped to dispel such doubts and misconceptions. The community preferred to rely on assurances and explanations of their own opinion leaders.

## *Dialogic Process*

The slow step-wise approach made the field team's task much more difficult than the traditional approach of "handed down" instructions. The real challenge was that each step taken collectively with the people had to be based on popular agreement on the previous step's results. Gradually, the majority of the water users were convinced that the pilot projects were for their own benefit, but something they had to work hard to build by themselves. This effort was not without misunderstandings and objections. The challenge itself provided a motivation to the social organizers and participant water users. It was a valuable experience for the field team members to see how some of the water users played the role of promoters of WUOs to argue with and convince their own fellow water users who were showing dissent.

Sometimes, the efforts of the field team in trying to forge some agreement and some confidence among the people were followed by extremely frustrating negative results. One such significant obstacle was the widespread rumor originated by a few persons with vested interests that the action research program was a ploy adopted by the donors and the government to increase water charges. Often, the strategy adopted to overcome such constraints was to generate internal discussions in small groups with the help of SOVs and allow time for a consensus to be developed among the water users, on the basis of information collected by themselves. Table 2 illustrates how the participation rate gradually improved with the increased intensity and formality of social organization interactions, which progressed from very informal rapport-building meetings (second dialogic step) to very formal federation meetings (last dialogic step).

## *Identification of Organizational Leaders*

The action research design generated four main procedural emphases for selecting organizational leaders for each level of the organizational structure:

1. Organization activities were conducted essentially in a *participatory* mode.
2. *Equal opportunity* was provided to all water users to participate.
3. Selection of organizational leaders was effected in a *democratic* way.
4. Selection was done on the basis of *consensus,* and not on open competition.

TABLE 2.
Participation rates* at different dialogic steps.

| Pilot site | Rapport-building meetings | Consultation meetings | Selection meetings | Federation meetings |
|---|---|---|---|---|
| Hakra 4-R | 10 (n=3,494) | 40 (n=3,494) | 76 (n=3,494) | 96 (n=25) |
| Bareji | 29 (n=354) | 58 (n=354) | 72 (n=354) | 90 (n=48) |
| Dhoro Naro | 14 (n=504) | 50 (n=504) | 53 (n=504) | 80 (n=50) |
| Heran | 12 (n=1,076)** | 51 (n=1,076) | 64 (n=1,076) | 96 (n=62) |

*Number of persons who participated as a percentage of the maximum number (n) of persons expected to attend the respective Dialogic Step. ** This increased number, as compared with the number given in table 1, includes some tenants who had since been admitted as legitimate water users in Heran Distributary.

The water users, who were recognized by the community of the command area in terms of legally accepted warabandi lists, formed the base group from which all of the leaders were selected for different organizational levels. These lists reflected a more authentic situation regarding the eligibility of persons for membership in water user organizations, and the numbers were slightly different from the total population identified during the baseline surveys conducted in pilot areas. Since the methodologies of selecting organizational leaders in Punjab differed from those deployed in the Sindh Province, the two sets of data are analyzed separately in the following sections.

## *Leaders at Hakra 4-R Distributary*

At the Hakra 4-R Distributary site in the Punjab, the selection of four groups of organizational leaders was progressively effected. For three different levels of a hierarchy of organizations, namely, (1) the watercourse,[6] (2) a subsystem consisting of a cluster of watercourses, and (3) the distributary consisting of a number of such subsystems, the following four groups of organizational leaders were selected:

- Watercourse nominees selected by the water users of the respective watercourse on the basis of one nominee from each watercourse, as members of a Subsystem Water User Organization (WUO) for a defined cluster of watercourses.
- Subsystem WUO office bearers, selected by the members of the Subsystem WUOs.
- WUF members, also selected by the Subsystem WUO members, on the basis of five selectees from each of the five subsystems.
- WUF office bearers selected by the 25 WUF members.

### *Social Characteristics*

Table 3 presents a summary of the main social characteristics of the organizational leaders selected in this process at Hakra 4-R Distributary pilot site, compared with the averages for the base group of water users.

The average experience in irrigated agriculture among the selected organizational leaders seems

TABLE 3.
Main social characteristics of organizational leaders at different levels of the Hakra 4-R distributary pilot site.

| Group | Average age (years) | Average experience in agriculture (years) | Average number of years of schooling |
|---|---|---|---|
| All water users (n=3,494) | 49 | 28 | 3.3 |
| Watercourse-level nominees (n=120) for subsystem WUO membership | 46 (15-90) | 27 (0-70) | 8.6 (0-16) |
| Subsystem WUO office bearers (n=25) | 47 (28-79) | 28 (5-60) | 9.8 (1-16) |
| WUF members (n=25) | 41 (25-62) | 23 (8-45) | 11.1 (8-16) |
| WUF office bearers (n=5) | 46 (38-62) | 28 (20-45) | 10.2 (8-12) |

*Note:* Minimum and maximum values are given in parentheses.

[6]Watercourse is the tertiary level distribution canal providing water to *nakkas* (farm outlets), whereas, distributary is the secondary level distribution canal providing water to *moghas* (watercourse outlets). The distributary takes off from a main canal or a branch of a main canal (see figure 4).

to be consistently high, a factor that seems to have mainly guided the water users in their choices. A similar high value appears to have been given to the educational level of the organizational leaders at various levels, most of whom appear to be having a reasonable level of education (the average being 9 to 11 years of schooling).

Although some young persons have been identified as nominees for leadership at the watercourse level, more mature, more experienced, and more educated persons have been selected for higher-level leadership positions.

### *Pattern of Landownership*

Table 4 shows the pattern of landownership among the selected organizational leaders at different levels, in terms of both the land owned and operated within the watercourse from where the nominee was selected and the total land owned within and outside the Hakra 4-R Distributary. In rural areas, landownership is considered an important indicator of the influence a person can exert on others.

Table 4 also shows that the average extent of land owned by the watercourse-level nominees as a total group is higher than that of the selected Subsystem WUO office bearers, but is less than the averages for WUF members and office bearers selected by them. This shows that, once watercourse level leaders were identified, there had been a tendency towards selecting persons owning more land for positions of office bearers at higher organizational levels.

At a glance, it appears that the WUF members are the larger landowners. However, out of the 10 watercourse nominees owning 40 hectares or more each (table 5), none was selected as a WUF office bearer; only three were selected as WUF members; and only two as subsystem office bearers. The larger landowners selected for the various offices also have other qualifications, such as education and working experience. The 5 persons selected as WUF office bearers from the 12 nominees are medium-size landowners, their landownership ranging from 17.4 to 38.6 hectares each. Even among the ordinary WUF members, 14 persons own less than 24 hectares each, and only 3 persons own more than 80 hectares each.

Table 5 shows that a large proportion of the 120 watercourse nominees is within the 4-40 hectare landownership category. This distribution is fairly compatible with the distribution of the office bearers as well.

A large majority (92%) of the selected organizational leaders own less than 40 hectares each. However, the other 8 percent of the leaders who own more than 40 hectares each account for 44 percent of the total land belonging to the whole group. These statistics depict a highly skewed

TABLE 4.
Pattern of landownership among the selected organizational leaders.

| Group | Land owned at particular watercourse (hectares) | Operated area at particular watercourse (hectares) | Total land owned at Hakra 4-R Distributary (hectares) |
|---|---|---|---|
| All water users (n=3,494) | 5.7 | 10.28 | 8.4 |
| Watercourse-level nominees (n=120) for subsystem WUO membership | 11.4 | 8.8 | 16.3 |
| Subsystem WUO office bearers (n=25) | 8.8 | 7.9 | 14.1 |
| WUF members (n=25) | 15.3 | 16.1 | 21.1 |
| WUF office bearers (n=5) | 12.0 | 7.2 | 26.6 |

TABLE 5.
Landownership among the organizational leaders of the Hakra 4-R Distributary pilot site.

| Land size category | Number of persons | Percent of total | Total extent of land (ha) | Percent of total land | Mean extent of land owned |
|---|---|---|---|---|---|
| <1 ha | 3 | 2.5 | 0.6 | 0.02 | 0.20 |
| >1 to 4 ha | 16 | 13.3 | 38.1 | 1.5 | 2.38 |
| >4 to 10 ha | 33 | 27.5 | 219.6 | 8.7 | 6.65 |
| >10 to 40 ha | 58 | 48.4 | 11,159.8 | 46 | 20.0 |
| >40 to 100 ha | 6 | 5.0 | 431.6 | 17.1 | 71.93 |
| >100 ha | 4 | 3.3 | 674.0 | 26.7 | 168.50 |
| Total | 120 | 100.0 | 2,523.7 | 100.0 | 21.03 |

land distribution pattern. Given this skewed land distribution pattern, an interesting aspect of participation is that both the small landowners, and the big landowners, have shown an equal interest in forming WUOs. Both categories of people have a stake in joining the organizations; the small farmers wish to claim their share of water, whereas, the big farmers would like to safeguard their current favorable situation. The potential of these new WUOs would largely depend on their ability to coordinate these different expectations.

## *Organizational Leaders of Sindh Pilot Sites*

In the three Sindh sites, each watercourse group nominated two persons as members of the distributary level WUF directly, bypassing the need for an intermediary subsystem level WUO. The decisions on the organizational structures were taken by the water users themselves in their consultation meetings, and they reflected rational thinking, as the three Sindh secondary canal pilot sites were much smaller than Hakra 4-R Distributary in the Punjab. Their main characteristics can be seen in table 6.

In terms of landownership, the selected organizational leaders for the 80 WUAs in the Sindh sites reflect the general characteristics of the water user community in the area. The baseline survey showed that the majority of the water users were small landowners (average extent owned by a water user was found to be only 2 ha in Bareji, 3.5 ha in Dhoro Naro, and 4 ha in Heran). However, in terms of their educational level, the pattern contrasts with the community distribution; table 6 shows that despite the large proportion of illiterate people in the community (64% according to the baseline survey), only a few uneducated persons have been chosen as WUA leaders.

Understandably, the water user community has included only a very small percentage of tenants and lessees among their selected leaders. A special reason for this collective decision is the temporary nature of the tenurial relationships in the Sindh Province. Tenants are often changed on a regular basis, and consequently, the tenants themselves show little interest in undertaking responsibilities in water resources management.

## *Demonstrated Ability for Collective Action*

The actions so far taken by the new water user organizations are mainly in seven areas:

TABLE 6.
Profile of WUA office bearers in the Sindh pilot sites, numbers, and percentages.

| Landownership | Bareji n = 116 | Dhoro Naro n = 195 | Heran n = 239 |
|---|---|---|---|
| 0 – 10 hectares | 72 (62.1) | 136 (69.8) | 145 (60.7) |
| >10 – 20 hectares | 15 (12.9) | 34 (17.4) | 82 (34.3) |
| >20 – 30 hectares | 13 (11.2) | 9 (04.6) | 5 (02.1) |
| >30 – 40 hectares | 3 (02.6) | 2 (01.0) | 5 (02.1) |
| >40 hectares | 13 (11.2) | 14 (07.2) | 2 (00.8) |
| **Tenancy status** | **Bareji n = 116** | **Dhoro Naro n = 195** | **Heran n = 239** |
| Landowners | 73 (62.9) | 94 (22.1) | 102 (42.7) |
| Owner-operators | 24 (20.7) | 68 (32.9) | 106 (44.3) |
| Lessees and tenants | 8 (07.0) | 17 (08.8) | 30 (12.6) |
| *Kamdars* (managers) | 11 (09.5) | 16 (08.2) | 1 (00.4) |
| **Educational status** | **Bareji n = 116** | **Dhoro Naro n = 195** | **Heran n = 239** |
| Illiterate | 17 (14.6) | 43 (22.1) | 35 (14.6) |
| Primary | 53 (45.7) | 79 (40.5) | 42 (17.6) |
| Matric | 22 (19.0) | 43 (22.0) | 85 (35.8) |
| Intermediate and above | 24 (20.7) | 30 (15.4) | 77 (32.2) |

*Note:* Percentages are given in parentheses.

- distributary maintenance
- preparations for more equitable water distribution
- establishing offices and bank accounts
- negotiations with government authorities
- agreements with input suppliers and purchasers of produce
- developing consensus among the members for these actions
- membership drive

### *Organized Action in Distributary Maintenance*

The water user organizations mobilized sufficient resources to undertake desilting of their respective distributaries at all the pilot sites. During this organized desilting operation, the water users demonstrated much enthusiasm and cooperation among themselves. The office bearers monitored and coordinated the desilting process, allocated the financial as well as human resources, and organized the work equitably among the various watercourses. An evaluation of this work reported that a significant feature of this activity was the unprecedented organized action in mobilizing resources and attending to a well-prepared maintenance plan. Water users assigned various parts of the command area to each office bearer for collecting an equal amount of dues per water user. There was wide publicity for the process of collecting dues so that there were no free riders. The WUOs, through discussions in their various meetings, identified some critical infrastructure development work items that would improve the physical system in their respective distributaries. The Irrigation Department gave official approval before the WUOs undertook the physical work, mostly with their own resources. The project provided technical assistance and some funds for procurement of cement and bricks. Table 7 shows

the assessed value of the items of work accomplished through collective action during 1997 and 1998 canal closure periods.

The socio-technical linkage in collective action has been a key element in the design of this action research. The willingness of the water users to gain an understanding of their technical system encouraged them to get organized for managing the system, and for engaging in collective maintenance programs aimed at improving the productivity of water use. The intent of a maintenance program to fix all flow control structures required for the improved hydraulic operation of the system is to ensure that they can function both as flow control and flow measurement structures. In this sense, maintenance is a support activity to facilitate canal operations (Skogerboe, Paudyal, and Shrestha 1993). The information gathered through training programs covered the water supply situation, water distribution pattern, irrigation structures, channel reaches, channel physical conditions, existing maintenance strategies, involvement of beneficiaries, government agency role, and possible constraints. After acquiring a good knowledge of maintenance needs, maintenance requirements could be categorized either as essential structural maintenance, or deferred maintenance.

In addition to the maintenance training, the water user groups also participated in activities to acquire basic ideas about operating the physical system to distribute water equitably. Improved irrigation and agricultural practices formed the focus of a number of field visits to experimental stations and the demonstration plots established within the pilot areas. Diagnostic "walk-thru" maintenance surveys, which were conducted to list in detail all deferred maintenance needs along the distributary and minors, served to achieve the following main objectives:

1. Water users gained an understanding about the technical aspects of maintenance problems.

2. Field teams were able to benefit from farmers' views about maintenance problems.

3. Both groups collectively appreciated historical and social aspects of specific water management difficulties.

TABLE 7.
An assessment of expenditure for different activities by the water users of the pilot distributaries in rupees (US$1.00=Rs 40).

| Activities | Water User Federations of Pilot Distributaries | | | |
|---|---|---|---|---|
| | Hakra 4-R Distributary, Haroonabad | Dhoro Naro Minor, Nawabshah | Heran Distributary, Sanghar | Bareji Distributary, Mirpurkhas |
| Desilting 1997 | n.a. | 67,500 | 109,000 | 6,800 |
| Desilting 1998 | 124,000 | 25,700 | 92,000 | 56,000 |
| Development work | n.a. | 164,600 | 148,900 | 95,500 |
| Repair of head regulator | n.a. | n.a. | 5,000 | n.a. |
| Construction of WUF office | n.a. | 25,000 | n.a. | n.a. |
| Repair of WUF office | 10,000 | n.a. | 6,000 | 1,500 |
| Total assessed value | 134,000 | 282,800 | 360,900 | 159,800 |

*Source:* Zaman 1998 and Project Progress Reports.

### *An Attempt to Improve Equity*

The WUF of Dhoro Naro Minor attempted to modify outlet structures to ensure the delivery of water according to the agreed water rights and the related water allocation pattern. This work had to be suspended when the Joint Management Agreement between the WUF and the Provincial Irrigation Department (PID) was not ratified by higher authorities. However, the fact that the WUF was ready to undertake a change reflects the potential for effective M&O through collective action.

### *Short-Term Impacts*

After the formation of WUFs, the water users reported that the frequency of breaches in the Dhoro Naro Distributary declined by about 50 percent. One reason could be that some of the breaches that occurred in the past were probably man-made. The organized efforts in stabilizing and strengthening the weak points of the canal banks of the pilot distributaries also could have contributed to this reduction in incidents of breaches. The water users generally refer to some improvement in the water flow in the tail reaches in the distributaries, and attribute it to the organized desilting campaigns. The sharing of information among the water users has been enhanced by regular interactions in the WUO meetings.

## *Potential for Organizational Consolidation*

Institutionalizing an organization for collective action is based on a nested set of rules. External rules associated with institutional support for its legal recognition would lead to the organization's own rules of conduct (or rules for making collective choices), which in turn would determine the operational rules on how resource management is to be implemented. These "decision-making arrangements" (Oakerson 1992:46) largely determine the organization's capacity to proceed with the management tasks. Viability of an organization depends on its strength to make internal rules (i.e., rules of conduct and operational rules mentioned above), and to apply those rules effectively. Both these functions, however, depend largely on the strength of the external rule system, or the organization's legal environment.

With the enactment of Provincial Irrigation and Drainage Authority Acts (in Punjab on 2 July 1997, and in Sindh on 15 September 1997), the major part of the external rule base is in place. Regulations to these acts, once finalized, would clarify further the procedure for internal rules for WUOs. The pilot projects have preempted this step by developing bylaws for each pilot site organization, and entering into a negotiation process with the government authorities to finalize the bases for shared management of water resources. However, for a WUO to be an institution, it has to persist and develop to the point where it is commonly perceived as valuable and useful (Merrey 1993). As has been experienced in the earlier efforts in forming WUAs primarily for watercourse improvement in Pakistan, an organization formed for short-term objectives is merely a structure of identified roles accomplished by a few selected individuals, such as the president, secretary, and treasurer. At best, it can be referred to as an "organization," but often it is limited to an ad-hoc group of a few people working together to achieve a temporary task. Once the short-term objectives are achieved, such organizations can, and usually do, disappear.

The task of managing water resources in a common pool water resource system (e.g., distributary) through collective action gives the new WUFs and their member WUAs a more permanent objective for organization. Implementation of agreed water rights and other related bylaws for reliable and equitable water distribution among watercourses and member water users is the most significant management

task that will engage the WUFs on a continuing basis. Other similar persistent responsibilities would include resource mobilization for implementing recurrent management tasks, dispute resolution, interacting with outside groups such as the government and private sector organizations, seasonal planning for optimum crop production, managing the proper use of inputs, and profitable procurement and marketing efforts.

The Joint Management Agreements (JMAs) developed by the WUFs and presented to the government, though not formally signed by government authorities yet, reflect a common understanding between the water user groups and government agencies that there will be clearly defined water rights for WUFs beyond the distributary head regulator up to moghas, and through the involvement of their member WUAs, up to nakkas. These JMAs specify responsibilities and rights of both WUFs and government authorities. As the water users in pilot sites had felt that the water supply to these particular sites was purposely reduced by local irrigation staff, the JMA requires from the government an assured supply, "calculated on the basis of the average deliveries for the past two to three years."

While continuing to negotiate with the government for having the JMAs formalized, the WUFs have engaged in a number of other activities aimed at organizational consolidation, such as developing draft bylaws, holding regular meetings, and taking collective action for resource mobilization, capacity building, and dispute resolution.

## *Shared Management through a Combination of Property-Rights Regimes*

Once the organized water users take over the secondary level canal subsystems, the water resource system in the distributary can be treated as a common pool resource, which is owned and managed as common property. So far in the Sindh Province, through the JMAs developed by the Sindh pilot sites and accepted on principle by the government on 16 October 1997, the understanding is that "the right of use on the distributary, inclusive of all structures, will be handed over to the Water Users Federation for management." Due to a procedural difficulty caused by a delay in publishing rules and regulations under the Sindh Irrigation and Drainage Authority Act, the JMAs could not be legally formalized. In the Punjab Province, negotiations between the Hakra 4-R Distributary WUF and the Provincial Irrigation Department have succeeded in an agreement for a limited transfer of management responsibilities, but its formalization has also been delayed until PIDA regulations are finalized.

In both provinces, a clear understanding has been reached that the Area Water Boards (AWBs) will manage the main canals, leaving the distributaries to the WUFs. Initially, the AWB is to be constituted with government-appointed board members, although some of them will necessarily be farmer representatives as specified in the PIDA law. To this extent, the main canal and its water would basically be state property until such time the AWB becomes a genuinely farmer representative body selected by the water users themselves. In the latter event, the part of the water resource system up to the head of the main canal can become common property.

In the present circumstances, as the action research design envisaged, the canal system above the head of the distributary would be state property, and the distributary and its water would become common property. Decisions on water rights and water distribution patterns within the distributary would largely be determined collectively by the WUOs. Interactions with the water users showed that the most significant motivating factor that tends to encourage the individual water users to join organizations is this potential for collective action to own and manage water resources in the distributary. The enhanced capacity to negotiate with the government agency regarding inter-distributary rotation schedules,

reliability of water supply, and upstream maintenance activities was cited as an advancement in local management. Similarly, the increased capability of the larger collectivized group—the WUF owning the common property of the distributary—for identifying and minimizing instances of free riding and rent-seeking, which are normally associated at the level of watercourse groups, was also highlighted as an advantage.

The water resources in a watercourse for a given warabandi turn remains as private property of the individual water user having that turn. Figure 4 gives the present and proposed property-rights regimes for a canal water resource system.

In a combination of property-rights regimes (state, common, and private), the interfaces between different regimes become important loci of complex human interactions. These interactions between different regimes are determined by sets of external and internal rules. Converting the distributary level water resource system from its present "state property" status to a "common property" regime, the farmer-bureaucracy interface is shifted to the head regulator of the distributary canal. While the external rules would largely determine the interactions at this interface, appropriate internal rules would determine the management of common pool water resources in the distributary. Either set of these rules will be the result of a series of negotiations between the water users and the government.

The private property regime associated with water resources in the watercourse and its application in crop fields also requires that the handling of surplus water is a private responsibility until it reaches a drainage facility commonly owned by a WUO. The water users have already acknowledged their readiness to own this responsibility, and also indicated the possibility of the WUF undertaking drainage responsibility within the distributary command area, until the collected surplus water reaches a larger drainage facility operated by a state agency.

In this combination of property rights regimes, a significant effort is necessary to effectively reorient roles of the state, community, and the individual. At the top level of the canal system, the state will be responsible not only for the management of reservoirs and main canals, but also for determining higher-level allocation rules with greater clarity. At the distributary level, the communities will adhere to the allocated water and take the responsibility for the equitable distribution of water according to their own agreed internal rules, and also for mobilizing resources for managing the distributary as well as sharing the upstream canal management cost with the state. Much greater freedom can be exercised by the individual water user at the watercourse level, once their water allocations are known.

Figure 5, which is an adaptation (Chambers 1988:36) depicts the interfaces between water users, their organizations, and the state. Appropriately formulated external and internal rules for this new institutional arrangement would guide the functioning of these various interfaces. This action research program envisaged a series of negotiations between the government and the water users (at least the pilot WUOs) in developing external and internal rules. However, some delays in identifying the desired institutional framework for managing water in the main canal and above became a constraint to this desired process. Until the closure of the present phase of the action research program, no Area Water Board (AWB) was established in the canal system. The new Provincial Irrigation and Drainage Authority laws do not provide for fully farmer-managed systems at the main canal level, as the AWBs are to be formed out of a combination of professionals and some farmers, both categories appointed by the government.

FIGURE 4.
Property rights of a water resources system.

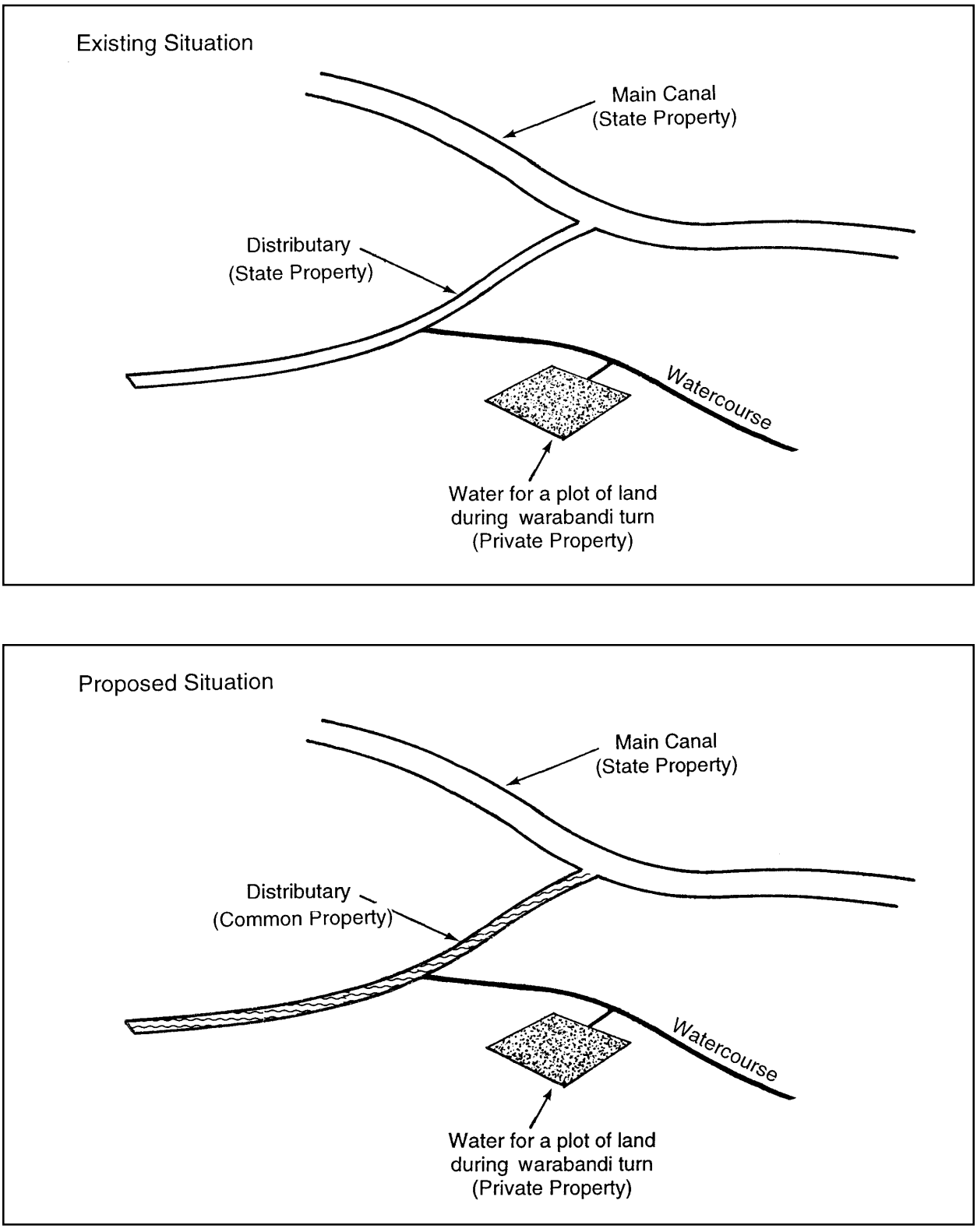
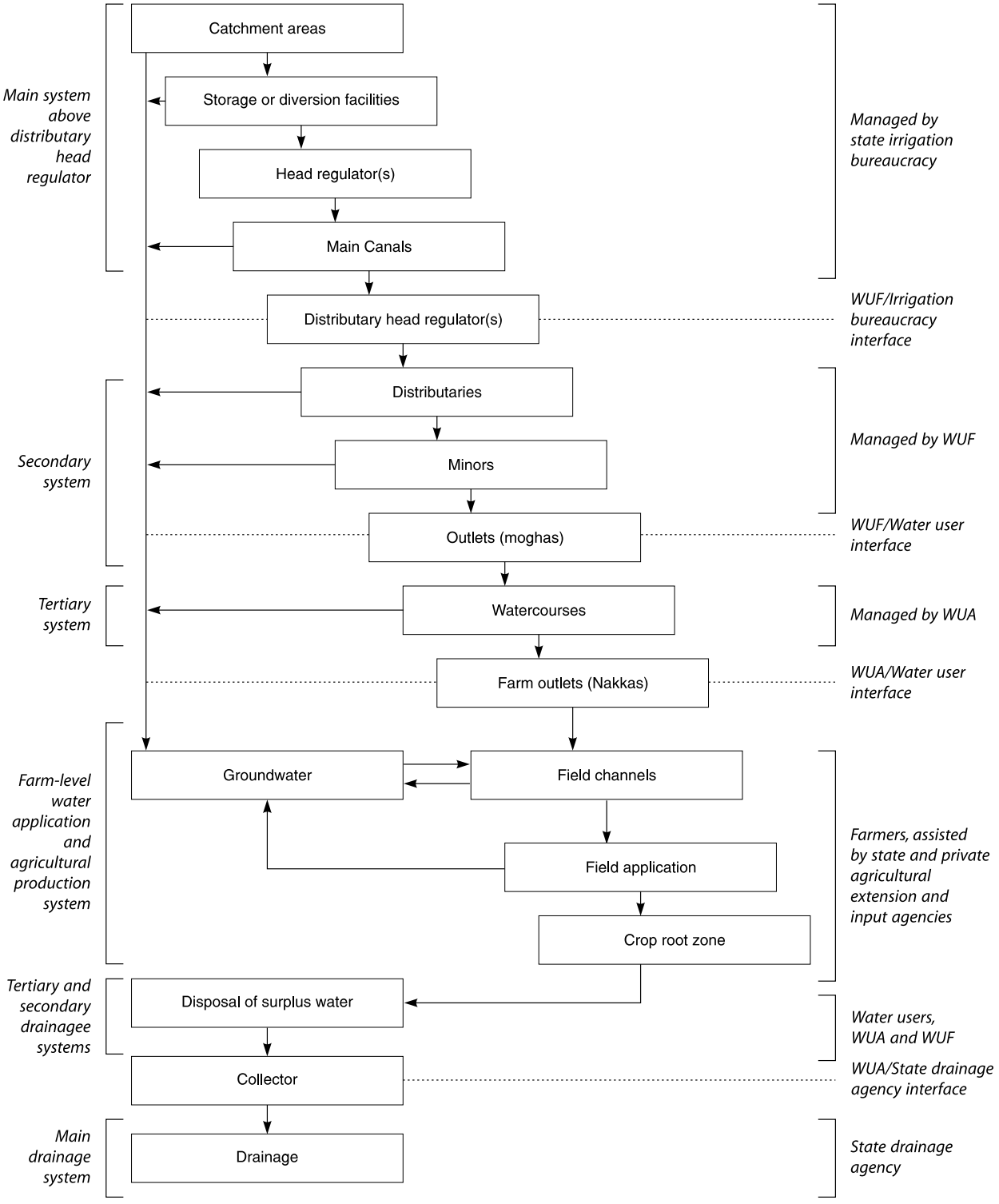


FIGURE 5.
Shared water resources management (WRM)* in large canals.




*WRM covers O&M of physical systems, water use and disposal, and related environmental aspects.

# Conclusion

The action research has shown that, with adequate opportunity to freely interact among themselves, the water users in the pilot sites are capable of selecting their organizational leaders in a democratic manner to include representation from all sections of the community.

Methodologically, the deployment of community-based volunteers and the strategy of deviating from the usual system management emphases and government budgetary imperatives for social organization paid dividends. The prolonged confidence-building efforts adopted in a dialogic approach helped in improving the trust, not only between the community and the change agents, but also among the water users themselves. In a participatory action research mode, the water users in the pilot areas engaged themselves in a series of consultation meetings to identify their needs for collective action, planned the needed organizational mechanisms, established primary and secondary level user groups, and federated them in a composite, representative organization. They proceeded to test their organizational capacity by successfully mobilizing resources, collectively planning urgent maintenance activities, and implementing a program of action during the canal closure period. In this process, they also identified means of improving equitable water distribution within their distributary canal command area and resolved preliminary conflicts confronted in this collective action process. Social organization field teams played a facilitating role, with occasional attempts at some elements of social engineering.

One constraint has been the reluctant participation by the bureaucracy in this institutional development effort. This is not surprising. In many countries where social experiments have been attempted, the main resistance to change has come from the bureaucracy. Despite this constraint, the satisfactory situation involving three other main actors (community, opinion leaders, and political leaders) could be identified in the following preliminary findings:

1. Initially, the members of the community in all of the pilot project areas were reluctant to participate in any form of interaction with the field teams. This initial diffidence was transformed to a gradual appreciation of self-management concepts and the need for getting organized. Once organized, they successfully tried some maintenance and equity improvement strategies. With the confidence gained, they are now keen to take over the distributaries from the government as fully farmer-managed systems.

2. Socially differentiated groups, such as head-end and tail-end water users, large and small landowners, landowners and tenants, and influentials and vulnerable groups, have all participated in forming the WUOs. A democratic process for selecting the WUO leaders was successfully tested.

3. Political leaders have provided a nonpartisan sponsorship without interfering in this social organization process. The acceptance of the new WUOs by the community is almost unanimous.

Usually, the fairly well-established rural leadership ensures that radical changes in attitude do not occur quickly among the ordinary members in the community; the same leadership tends to take over any rural organization that is sponsored by top-down approaches. However, this action research shows that, given the equality of opportunity and the democratic process for

selecting organizational leaders, possibilities exist in increasing the extent of participation by traditionally marginalized groups. The selection of a majority of medium-size and small landowners, and even a few tenants as WUO leaders, avoidance of influence by competing political parties, and reasonably equitable considerations in decision making seen during a short period of time in this social organization action research indicate a good potential for avoiding the usual dominance by large landowners.

One important area for continued research remains in validating the economic gains from collective action through a combination of property-rights regimes in the context of large irrigation canals. The new pilot WUOs could not effectively take over management responsibilities from the government as the enabling legal framework was not complete on time for the action research. Consequently, they were unable to spend sufficient time in collective action, and fully test their ability for managing water resources for increased productivity in irrigated agriculture as envisaged. Yet, they have proceeded to build their capacity for achieving this goal, should the opportunity be given to them in a not too distant future.

Another area for further research is to identify the strategies with which a demand-driven bottom-up approach to establish decentralized mechanisms for the management of water in large canal systems can be institutionalized in the present sociopolitical culture in South Asia. More specifically, what are the conditions under which the dominance of both the large landowners and the state can be minimized to allow for genuine and sustained popular participation in resource management in the rural sector?

So far, there has been a slow but clearly discernible shift in the attitude of the elected political leadership towards appreciating the value of self-reliance that has been demonstrated by the new WUOs. Whether this trend would continue is yet to be seen. Right now, it appears to be prompted by donor influence and the urgent need to mobilize resources for rural development. In this context, however, the willingness of the political leadership to replicate pilot efforts and some elements of the new approach on a wider scale in all the four provinces in Pakistan augurs well for the immediate future.

However, the action research efforts were not without the constraints of usual bureaucratic delays and apathy towards change. The action research program remains as an unfinished agenda. The unprecedented enthusiasm generated among the water users through the bottom-up social organization approach in forming water user organizations is confronted by the rigor of traditional top-down planning processes for establishing the Provincial Irrigation and Drainage Authorities and Area Water Boards. Whether an enlightened political leadership can effectively neutralize the forces of traditional vested interests against change in the rural sector is an open question.

## The Context

The "crafting" of new irrigation institutions needs to take into account a number of contextual variables that contribute towards performance (Ostrom 1992). While designing this action research program, an effort was made to make its objectives and methodologies compatible with the context of Pakistan. A brief description of this context is given below.

### *Physical System*

Pakistan's heavy investment in irrigation infrastructure has given the country the world's largest contiguous canal irrigation system. The massive resource base of the Indus Basin Irrigation System is the cumulative effect of more than a hundred years of consistent investment in irrigation development. The Indus Basin Project (IBP) of the 1960s alone saw an increase in the total water supply for irrigation from about 79 billion cubic meters at the time of independence to almost 135 billion cubic meters by the end of the IBP effort (Bandaragoda 1993:10).

Pakistan's irrigation system, which is based on the original objective of irrigating the maximum possible area from the available water supplies, is characterized by the following main features:

- run-of-river water supplies
- protective irrigation
- low water allocations of 0.21-0.28 l/s/ha (3-4 cusecs per 1,000 acres)
- low cropping intensity (annual average 75%)
- infrastructure designed for equity and reliability of supply
- few gated structures and minimal operational adjustment required
- proportional outlet structures drawing design discharge

### *Social System*

The operation and maintenance of this extensive irrigation system and its related drainage and flood protection measures have largely been the responsibility of the government. The Provincial Irrigation Departments (PIDs) are responsible for the major part of the task, which is the O&M of the main and secondary canals, while the farmers attend to the maintenance of the tertiary level watercourses.

A hierarchy of organizational units is involved in the O&M of a typical canal system. An Executive Engineer playing a pivotal role in canal administration is in charge of a canal Division, which is the executive unit for operational activities, and he functions under the administrative control of a Superintending Engineer, who is the head of a Circle consisting of two or three Divisions. The Superintending Engineer of a Circle reports to the Chief Engineer, who oversees a number of such Circles. A Division is further divided into three or four Subdivisions, each headed by a Subdivisional Officer (SDO), who is also a qualified engineer. A Subdivision, ordinarily, consists of three or four Engineering Sections and two to three *Zilladari* or Revenue Sections. The head of an Engineering Section is a Sub-Engineer, who is responsible for the distribution of supplies and the maintenance of secondary level discharge up to about 2 to 4

cumecs (100 to 150 cusecs). The Sub-Engineer is assisted by Masons, Mistries, Mates and Canal Patrols for maintenance and watching of channels, and also has gauge readers for regulation and observation of water flow. A Zilladari Section is headed by a Zilladar who supervises the work of about 10 *Patwaris* (Irrigation Record Keepers), each Patwari being required to record the extent of irrigation of 1,200 to 2,000 hectares.

The pattern of staff distribution deployed to operate a canal system under the traditional design has remained largely unchanged since the inception of the existing canal irrigation administration in the late 1800s. As the system was designed for a low management intensity, the density of irrigation staff is lower in the subcontinent than in many other irrigated areas. The average irrigation staff per 1,000 irrigated hectares is in the order of 3 to 5 in many of these canals, compared to around 25 in South Korean canals (Wade 1988). However, the performance of this static irrigation bureaucracy in the subcontinent has been known to be on the decline, and its character has been basically control-oriented rather than service-oriented.

A largely uncoordinated institutional framework compounds this situation further. Federal responsibility for resource allocation, provincial responsibility for irrigation management, large organizations with centralized administration, large numbers of water users with little involvement in irrigation management decisions, difficult coordination among agencies and their subunits and functions, numerous laws and procedures mixed with traditional concepts and sporadic amendments by occasional enactments and promulgations, and more importantly the countervailing forces that act against formal rules, all contribute to the complexity of Pakistan's irrigation institutions.

In sum, the following main institutional factors affecting irrigation performance in Pakistan can be identified (Bandaragoda and Firdousi 1992):

- the overriding effect of socially evolved informal institutions over the formal rules and management decisions
- the obsolescence of irrigation rules, codes, and procedures
- the declining relevance of organizational structures in the light of changed circumstances

## *Socioeconomic Changes*

With the political development following independence, the irrigated agriculture scene underwent some changes (Bandaragoda 1996). Populist approaches of a newly emerging democracy tended to bring about substantial influence on many aspects of canal administration that, through a cycle of mutually reinforcing social factors, led to the present situation of free riding and rent-seeking. Most of the traditional design features have outlived their usefulness in the context of these changed social conditions. The ideas of "protective" irrigation and equitable water distribution embodied in the early design criteria are no longer readily applicable. Interacting changes in the operational environment resulted in increased indiscipline in the operation of the system, poor maintenance, demand for more irrigation water and for its greater reliability, uncontrolled groundwater development, increase in cropping intensities (over 100% in many systems), and diversified cropping patterns.

For instance, general deterioration of the physical infrastructure, coupled with operational irregularities, adversely affected the reliability of irrigation water supplies, as well as the equity of water distribution within the system. As the number of small farms increased due to subdivision and transfer of land, the emphasis of objectives in irrigated agriculture started to shift from productivity per unit of water to productivity per unit of land. The cumulative effect of these political and socioeconomic changes can be seen

in the present social setting of Pakistan's irrigation, which can be outlined by the following main features:

- skewed landownership pattern
- increasing number of small landholders due to fragmentation of land
- highly centralized irrigation administration
- lack of accountability
- rampant rent-seeking behavior
- political interference in administration of the irrigation systems
- inequity in water distribution

## *Constraints on O&M Budgets*

For the projects before independence, during the First Five-Year Plan period (1955-60), the share of public investment on agriculture and irrigation was around 30 percent. This share increased to about 46 percent during the Second and Third Plan periods (1960-70) when the Indus Treaty projects were implemented, but since then has declined rapidly to a level of about 17 percent in the Sixth Plan period in the 1980s (Hamid and Tims 1990). Although the share of the government budget for development work has gradually declined since the completion of the IBP, the government continued to allocate resources for upgrading and enhancing the system to meet an increasing demand for irrigation.

The annual O&M allocations for the PIDs gradually became insufficient due to inflation and heavy inter-sector competition for resources, and the management of O&M became increasingly ineffective due to changing socioeconomic conditions. Despite the increases in water charges (e.g., an average of 5% per annum from 1983 to 1987), the revenues as a percentage of O&M costs declined (e.g., from 53% to 38% during the period). Increases in O&M costs, low assessment of water charges, and low recovery rates, all combined to form this imbalance (Water Sector Investment Plan 1990).

With inadequate maintenance, the canal system started to deteriorate. The resultant decline in performance deprived the country of its expected return on investment in irrigation development. Pakistan's crop yields remain generally low, or have progressed only very slowly when compared to the crop yields in many other countries. Similarly, poverty has stubbornly persisted in rural areas despite their proximity to irrigation (Ministry of Food and Agriculture 1988). A daunting aspect of this unsatisfactory irrigation performance, despite the favorable resource base and related technological advances, could well be a substantial food deficit in the future, particularly in view of the country's fast-growing population.

## *Attempted Remedies*

Donors and external evaluators started to draw attention to the need to identify correct solutions to improve this state of unsatisfactory performance. Their proposition was that Pakistan's major irrigation problems were not due to water shortage. Therefore, instead of investing on further expansion of the physical system, performance improvement could be achieved by introducing and sustaining appropriate institutional and management innovations.

Illustrating this concern, the World Bank, United States Agency for International Development, and other donors focused their attention on management rather than on construction. For example, the World Bank funded four projects: On-Farm Water Management Projects I and II (1981-1992), Irrigation System Rehabilitation Project (1982-1987), and Command Water Management Project (1984-1992) to address the major system management and institutional issues. All these four projects, at an investment level of US$175 million, were to concentrate on reducing drainage and saving water using existing infrastructure, rather than building new dams. Further, each of these projects had a specifically designed institutional component. The importance

of this shift of emphasis was further accentuated by continued donor pressure for institutional reforms, which resulted in a slow movement towards change. This situation is summarized below.

1. Provincial legislation was passed in the early 1980s, allowing the formation of Water User Associations (WUAs) on individual watercourses. Since that time, thousands of WUAs have been organized with government subsidy and support given under the On-Farm Water Management (OFWM) development program.

2. In some selected command areas, a certain degree of institutional coordination was attempted under the Command Water Management Program (CWMP), in which farmer participation was made an essential requirement for project implementation.

3. Various evaluations of this work (e.g., Byrnes 1992; Asrar-ul-Haq, Shahid, and Akram 1996) created the common impression that these attempts at farmer involvement in the management of the irrigation system did not lead to sustained farmer participation or to lasting benefits. The World Bank's post-project evaluations later confirmed that the projects achieved their physical components (watercourse water losses reduced from about 40% to 25–30%; and annual water savings from the four projects amounting to about 2.3 billion cubic meters), but failed in most of their institutional objectives. The evaluations further commented that the newly formed WUAs, to meet project conditions, were merely token associations or the old watercourse committees renamed, making the whole exercise an "empty ritual" (World Bank 1996).

4. Government policy makers started to participate in discussions with the donors on possible institutional reforms. Several seminars were held among local opinion leaders to discuss the implications of suggested reforms, and these ideas were later expressed in published form (e.g., Asrar-ul-Haq, Shahid, and Akram 1996).

5. Meanwhile, the World Bank in their report on "Pakistan, Irrigation and Drainage: Issues and Options" (World Bank 1994) proposed a reorganization of the whole irrigation sector, including the establishment of autonomous public utilities for the management (including operation and maintenance) of the irrigation water. Many government officials found this approach too radical, but recognized the need for some institutional change.

6. An initial government agreement on the need to change was achieved at a seminar on "Participatory Irrigation Management," co-sponsored by Pakistan's Ministry of Water and Power and the World Bank's Economic Development Institute (EDI), which was held in Islamabad during 2-6 October 1994. This initiative was followed by another EDI-sponsored workshop held in Burban (a hill resort close to Islamabad) in October 1995, during which the representatives from four provinces worked out tentative action plans for institutional change.

7. In the midst of considerable pessimism about participatory irrigation management and its validity in Pakistan's large canal systems, a consensus started to develop on the need to undertake some pilot projects in selected locations.

8. IIMI's study results over the past decade in irrigation system management, policy, and institutional analysis in Pakistan coincided with, and have probably helped to catalyze, these newly emerging concerns and interests (Bhutta and Vander Velde 1992; Vander Velde and Murray-Rust 1992; Bandaragoda and

Firdousi 1992; Bandaragoda 1993; Restrepo, Bandaragoda, and Strosser 1994; Bandaragoda and Saeed ur Rehman 1995).

9. Currently, there is a growing awareness regarding the necessity for farmers' involvement in O&M, often prompted by donor concerns, and also based on the realization that declining budgetary capacities were continuing to have adverse effects. Yet, there is considerable pessimism among many government officials about being able to form effective farmer organizations and their impact on the productivity and sustainability of irrigated agriculture.

Most of the contextual factors outlined above seemed to favor an increased involvement of the water users in managing the present situation. For instance, by bringing management closer to the users, the accountability for scarce water resources was more likely to be improved. Additionally, by fostering maximum participation, the alliances made between some of the water users and the officials based on their vested interests were more likely to be minimized. Also, collective action seemed to be the best way of reducing irrigation misconduct among the water users themselves.

Although it has been a slow process of change, Pakistan's current strategy for institutional change in this vitally important water sector appears to have some practical and contextually appropriate elements. Sensing the initial objections to concepts, such as "privatization of irrigation" and "irrigation management turnover," the planners shifted to a strategy of organizational reform as an initial step. While many other countries floundered on this essential requirement, and generated very disappointing results after their enthusiastic beginnings on management transfer plans, Pakistan put forward the ideas of "decentralization" and "participatory irrigation management" to neutralize initial political objections. The reforms started with the enactment of new laws in the form of Provincial Irrigation and Drainage Authority (PIDA) Acts of 1997, and the appointment of PIDA Boards. Even if these initial intentions were to be proved less than totally pure, the firm legal foundation laid out through these preparatory activities would serve as a basis for local-level awakening.

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