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Kerry J. Byrnes
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Kerry J. Byrnes
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Cover: Bottom right photo shows Water Users Association (WUA) members meeting to discuss water problems. Top left photo shows one of the positive results of WUA efforts—an improved brick and cement-lined watercourse carrying water more efficiently to farmer fields. The map (bottom left) illustrates the watercourse in relation to the larger irrigation system. The cube (top right) represents the complex of management decisions that farmers, through their WUA, make in regard to water control structures, water use, and organization for problem solving.

Credits: The cover’s montage was conceived by the author and executed by the World Bank’s art staff. The two photos are courtesy of the Pakistan On-Farm Water Management Programme. The schematic map of a Pakistani irrigation system is from Merrey (1986b), while the water management cube is from Uphoff, et al. (1985).

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FOREWORD

The field study carried out by sociologist Kerry J. Byrnes on Pakistan’s water users’ associations (WUA) examines one of the most interesting social experiments in World Bank financed irrigation projects. The essence of this experiment is a significant enhancement of the organizational capacity of the local social actors in state owned irrigation systems. This capacity becomes a strategic resource for development and environmental management.

Informal associations of users at the watercourse level first appeared in Pakistan about 18-20 years ago. Often they were loosely rooted in pre-existing, non-water related, kinship systems or neighborhood networks. Formal WUAs, as organized structures with defined functions and recognized legal status, were first established in 1981. Since then more than 14,000 WUAs have been formally constituted. To cover all of Pakistan’s irrigated land, watercourse by watercourse, some 100,000 WUAs would be needed. Although there is still a long way to go, the creation of these 14,000 organizations — notwithstanding their weaknesses, teething problems, or various failures and setbacks — is already an extraordinary accomplishment. It is a leap forward in asserting users’ roles and participation in water management, in purposively creating a new social fabric intended to endure, and in mobilizing human and material resources for immediate activities of mutual benefit. The development of these new social patterns is vividly reconstructed and insightfully examined by the author of this study, which informs both the practitioners who might be interested in replicating this development and the researchers interested in understanding change.

Controversy and failures have surrounded many richly financed irrigation programs which invested only in the physical canal networks but neglected to create the social institutional structures indispensable to, and appropriate for, the new physical structures. Major problems and underperformance have ensued in many countries. The series of three successive On-Farm Water Management Projects in Pakistan (stretching from the late 1970s until the present), prepared and implemented with Bank assistance, represents one of those innovative programs which broke with past technocratic and econocratic approaches, and recognized the crucial role of local social actors. This on-farm program has allocated special investments to help create the missing social infrastructure of irrigation systems.
During this process, two fundamental assumptions were proven correct: first, that financially induced development can promote the establishment of new patterns of social organization, not only the transfer of hardware technology or civil works; second, that the enactment of legal frameworks — such as the ordinances issued by each of Pakistan’s provinces to legitimize the creation of WUAs and confer on them legal recognition as corporate bodies — can be used as a powerful lever for social development, in judicious combination with other stimuli.

Kerry Byrnes’ study explores how the three main sets of WUA functions are performed: (a) water management — allocation/distribution; (b) infrastructure maintenance at the system’s end-level; and (c) management of the members’ group itself. The study found significant variation in the degree to which different WUAs, once formed, continued to be effective participants in irrigation management or in other functions. Many of the WUAs studied were most active in watercourse design, construction, or brick-lining, and more broadly in resource mobilization. However, after physically improving the watercourse some WUAs faded, for various reasons, while others became active in water-related decision making and conflict resolution. Dr. Byrnes also identifies the areas in which further assistance could overcome persistent institutional weaknesses and increase the returns on investments in WUAs.

The multidimensional experience and the various puzzles inherent in WUAs’ development and in their good or poor performance invite further sociological field investigation. The number of Pakistan’s WUAs continues to increase, but they also encounter new problems of their own or of irrigation system development. Their potential, however, is demonstrated beyond a doubt: as they gradually mature and federate, these WUAs hold an attractive promise of taking over a share of the responsibilities currently vested in governmental agencies, and of expanding their participation in system management beyond the watercourse.

Michael M. Cernea
Senior Adviser, Sociology/Social Policy
Environment Department
The World Bank
This study, sponsored by the World Bank, was carried with the kind assistance and generous collaboration of many persons in Pakistan and in the U.S.

The author acknowledges the guidance of World Bank officials in Washington, D.C. and in Islamabad, Pakistan. Michael M. Cernea, the World Bank's Senior Sociology Advisor, played a central role in the study's initiation, conceptualization, and oversight. Bank staff such as Warren D. Fairchild (ASPAA) and C.P. Cheng (ASPAA) were helpful in providing background on the development of World Bank support for Pakistan's On-Farm Water Management Program. Other bank staff commented on the scope of work for the study and/or drafts of this report. The Bank's Resident Mission in Islamabad kindly provided advice and logistical support for carrying out the field work, and assistance in making contacts with the Pakistani On-Farm Water Management (OFWM) officials and in coordinating trip itineraries. In particular, Anis N. Yousseff was most helpful in providing insights on the OFWM program, while administrative support was provided by Charles F. Nottridge and Mahmud A. Khan.

The field trips and interviews would not have been possible without the assistance and collaboration of the many Pakistanis associated with the various On-Farm Water Management Projects supported by such donors as the World Bank, Asian Development Bank, and the U.S. Agency for International Development. In particular, the author greatly appreciates the assistance and interpreter services of Inayatullah (Consultant, Ayoob Abidi Agricom Joint Venture) and Bashir Ahmed Bajwa (Project Manager, On-Farm Water Management, NESPAK) who accompanied the author during the first round of field trips to Punjab, Sind, and NWFP. The second round of interviewing, data recording, and post-interview analysis was facilitated by Nisar Ahmed in Punjab and Shamsul Qamar in NWFP.

The study owes a debt of gratitude to the On-Farm Water Management (OFWM) local officials in Punjab, Sind, and NWFP who gave of their time to answer questions and to travel with the author to the many watercourses visited during the study. OFWM personnel always were generous with their resources in ensuring that field-based OFWM personnel had scheduled the visits to the watercourses and the interviews with water users association (WUA) officials. The author greatly appreciates the Pakistani hospitality extended by OFWM personnel both in their offices and in the field.

This study could not have been completed without the participation of the many Pakistani farmers who comprise the membership of the WUAs visited during the study's field work. The study questionnaire's extensive and lengthy nature precluded being able to collect the needed data in short interviews. Often interviews lasted for one-two hours or even longer; and many watercourses (and associated WUAs) were revisited for followup interviews. As most interviewing was done during the day, the time shared by WUA members often was at the expense of not being able to attend to other farm and family responsibilities. Indeed, in several instances, interviews were put on hold so farmers could attend to their prayer hour. While the interviews were probably more exhausting for the respondents than the interviewer, the respondents nevertheless were most generous in sharing their views on their WUA experiences.

I express my appreciation to my father, Francis C. Byrnes, who assisted in the editing of the manuscript, and to Denise Duggin, Tracey Smith, and Gracie Ochieng who assisted in the preparation of the manuscript for publication. Any remaining errors herein are the responsibility of the author.
ACRONYMS

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ADB</td>
<td>Asian Development Bank</td>
</tr>
<tr>
<td>AO</td>
<td>Agricultural Officer</td>
</tr>
<tr>
<td>ac</td>
<td>Acre</td>
</tr>
<tr>
<td>af</td>
<td>Acre feet</td>
</tr>
<tr>
<td>Balu</td>
<td>Baluchistan</td>
</tr>
<tr>
<td>cca</td>
<td>Cultivable Commanded Area</td>
</tr>
<tr>
<td>cfs</td>
<td>Cubic Feet per Second (or cusecs)</td>
</tr>
<tr>
<td>cm</td>
<td>Centimeter</td>
</tr>
<tr>
<td>CFSC</td>
<td>Cooperative Farm Service Center (in NWFP)</td>
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<tr>
<td>CWM</td>
<td>Command Water Management Project</td>
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<tr>
<td>FA</td>
<td>Field Assistants</td>
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<tr>
<td>FGW</td>
<td>Fresh Ground Water</td>
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<tr>
<td>FWM</td>
<td>Federal Water Management Cell</td>
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<tr>
<td>GOP</td>
<td>Government of Pakistan</td>
</tr>
<tr>
<td>GOPunjab</td>
<td>Government of Punjab</td>
</tr>
<tr>
<td>ha</td>
<td>Hectare</td>
</tr>
<tr>
<td>IDA</td>
<td>International Development Association</td>
</tr>
<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
</tr>
<tr>
<td>lps</td>
<td>Liters per second</td>
</tr>
<tr>
<td>m</td>
<td>Meter</td>
</tr>
<tr>
<td>M</td>
<td>Million</td>
</tr>
<tr>
<td>MFAC</td>
<td>Ministry of Food, Agriculture and Cooperatives</td>
</tr>
<tr>
<td>MRES</td>
<td>Mona Reclamation Experiment Station</td>
</tr>
<tr>
<td>NWFP</td>
<td>North West Frontier Province</td>
</tr>
<tr>
<td>O&amp;M</td>
<td>Operation and Maintenance</td>
</tr>
<tr>
<td>OFWM</td>
<td>On-Farm Water Management</td>
</tr>
<tr>
<td>PID</td>
<td>Provincial Irrigation Department</td>
</tr>
<tr>
<td>PLL</td>
<td>Precision Land Levelling</td>
</tr>
<tr>
<td>RAP</td>
<td>Revised Action Program</td>
</tr>
<tr>
<td>SAR</td>
<td>Staff Appraisal Report</td>
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<td>SCARP</td>
<td>Salinity Control and Reclamation Project</td>
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<td>SDO</td>
<td>Sub-Divisional Officer</td>
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<tr>
<td>SGW</td>
<td>Saline Groundwater</td>
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<tr>
<td>T&amp;V</td>
<td>Training and Visit (Extension Program)</td>
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<td>Tubewell(s)</td>
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<td>W/C(s)</td>
<td>Watercourse(s)</td>
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CURRENCY EQUIVALENTS

Summer 1987

US $1 = Rs. 16.10
Rs. 1 = US $.0622

WEIGHTS AND MEASURES

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<th>Metric Units</th>
<th>Pakistani Units</th>
<th>Metric Units</th>
<th>English Units</th>
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<tbody>
<tr>
<td>1 acre (ac)</td>
<td>= 0.405 hectares (ha)</td>
<td>1 maund</td>
<td>= 37.32 kg (0.0373t)</td>
<td>= 82.3 lbs (0.0367 lg ton)</td>
</tr>
<tr>
<td>1 square mile (sq mi)</td>
<td>= 259 ha</td>
<td>26.8 maunds</td>
<td>= 1.0 t</td>
<td>= 2,205 lbs</td>
</tr>
<tr>
<td>1 cubic foot/second (cfs)</td>
<td>= 0.0283 cubic meters/second (m³/sec)</td>
<td>27.2 maunds</td>
<td>= 1,016 kg</td>
<td>= 1.0 lg ton (2240 lbs)</td>
</tr>
<tr>
<td>1 acre foot (af)</td>
<td>= 1,233.5 cubic meters (m³)</td>
<td>1.0 mawn</td>
<td>= 50 kg</td>
<td>= 110.23 lbs</td>
</tr>
</tbody>
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Schematic Diagram of Pakistani Irrigation System Including River, Main Canal, Distributary, Watercourse, and Branches
(Source: Merrey, 1986b:29)
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EXECUTIVE SUMMARY

This report reviews the experience of Pakistan’s On-Farm Water Management (OFWM) program in working with and through water users associations (WUAs) in World Bank-assisted irrigation projects. The report is based on in-depth interviews with officials and members of WUAs on 11 watercourses (W/C) in three Pakistani provinces—Punjab, Sind, and North West Frontier Province (NWFP)—during the summer of 1987. These interviews and secondary data sources (e.g., official World Bank files) provided the basis for writing a series of WUA case studies (available in a separate volume) and this report’s cross-cutting analysis. Chapter 1 provides an overview of Pakistan’s irrigation system, types of traditional irrigation systems, and how watercourse (W/C) maintenance traditionally was organized. Chapter 2 reviews the history of Pakistan’s WUAs; chapter 3, the WUA model; chapter 4, WUA performance; and chapter 5, approaches to improving WUA sustainability.

The study found that the process of organizing farmers on a W/C into a WUA has had a significant impact in terms of mobilizing the labor and funds required to design and implement projects to brick-line portions of the W/Cs that carry irrigation water from water sources to farmer fields. These projects, in turn, have helped Pakistani farmers to capture the benefits of improved irrigation management, measured in terms of greater irrigation efficiency, adoption of improved farming practices, and increased economic benefits from the productivity increments made possible by improving irrigation efficiency and adopting improved farming practices. Overall, farmers on most, if not all, W/Cs visited expressed that the W/C improvement program is the first and only government-sponsored scheme for the agriculture sector that has benefitted the farmer.

But the study also found significant variation in the extent to which the WUAs, once formed, continued to be active in facilitating farmer organization and participation in irrigation management (operation and maintenance) and other functions essential for agricultural and rural development. This variation was identified by looking at the role of WUAs as a catalyst for irrigation management activities in three areas: (a) water user activities (to provide water to crops in an adequate and timely manner); (b) control structure activities (to manage the structures that give control over applying water to crops); and (c) organizational activities (to organize the effort to manage control structures).

Generally, with respect to water use activities, the WUAs are relatively inactive, i.e., they engage in little or no activity with respect to the allocation, distribution, or drainage of water. Specific factors account for this inactivity. In the case of drainage, these WUAs are relatively inactive because their W/Cs suffer, as they perceive it, not from a surplus of water but rather from insufficient water. With respect to allocation, the lack of activity is primarily explained by the fact that the Pakistani irrigation system basically is supply-driven; that is, with the exception of tubewells (TWs), farmers get such water as spills from the distributaries through the moghas into farmers’ W/Cs. In turn, as regards distribution, the traditional warabandi system basically determines how the available water will be allocated. Finally, with respect to acquisition, few cases were observed or reported where WUAs had obtained additional water by installing TWs on their W/Cs. Yet the desire of farmers to install TWs as a means of acquiring additional water remains a factor that potentially could be used as an incentive to motivate additional collective action on the part of farmers.
By contrast, WUA activity levels were highest in the W/C improvement areas of design and construction (control structure activities) and resource mobilization (organizational activities). The desire of farmers to obtain additional water by participating in the improvement of their W/Cs provided an incentive for farmers to mobilize the required money and labor to complement the W/C improvement resources provided by the OFWM program. However, once a W/C is improved--and absent any additional incentives--the level of collective action vis-a-vis irrigation management activities generally reverts to that prevailing prior to W/C improvement. Specifically, farmers return to their traditional pattern of W/C operation and maintenance, whereby each farmer operates the irrigation system according his warabandi turn, with farmers periodically coming together to clean and maintain the W/C as traditionally was the case prior to W/C improvement. Generally, the establishment of legally-authorized WUAs on the W/Cs has not resulted in farmers drastically changing or going beyond what they traditionally accomplished through their informal khal committees. Only in a few cases have WUAs begun to play more active communication and decision making roles to help their members to take on agricultural development functions (e.g., buying inputs or obtaining loans) that go beyond the limited OFWM program objective of physically improving W/Cs. But the study has shown, perhaps as a somewhat unexpected finding, that the WUAs are playing an effective role in conflict resolution on the W/Cs, thereby creating for the future a greater potential for farmers, through their WUAs, to act collectively on common problems.

Based on the irrigation management activities of the 11 WUAs visited (6 in Punjab, 5 in NWFP), the WUAs were ranked according to an ordinal scale that provides an indicator of each WUA's relative level of organizational development. The scale value for each WUA was assigned according to the following ordinal scale:

10. WUA (or WU Cooperative Society) joined a federation of WUAs
9. Water Users Cooperative Society obtained a loan from bank
8. WUA registered as a Water Users Cooperative Society
7. WUA active (meetings and followup action) on other problems
6. WUA only active for W/C cleaning and maintenance
5. WUA mobilized resources for W/C improvement but now inactive
4. WUA registered but labor not yet mobilized for W/C improvement
3. Farmers engaged in group action to organize a WUA
2. Committee for W/C cleaning exists (e.g., khal committee)
1. Informal traditional organization for W/C cleaning exists

Based on this scale, the 11 WUAs were assigned the following values:

<table>
<thead>
<tr>
<th>Punjab</th>
<th>NWFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>134,812/R</td>
<td>7.0</td>
</tr>
<tr>
<td>27025/R</td>
<td>7.0</td>
</tr>
<tr>
<td>51170/L</td>
<td>6.5</td>
</tr>
<tr>
<td>5201/R</td>
<td>6.5</td>
</tr>
<tr>
<td>24879/L</td>
<td>6.0</td>
</tr>
<tr>
<td>20174/L</td>
<td>6.0</td>
</tr>
<tr>
<td>73483/L</td>
<td>9.0</td>
</tr>
<tr>
<td>Sherogay</td>
<td>7.5</td>
</tr>
<tr>
<td>22675/R</td>
<td>6.0</td>
</tr>
<tr>
<td>7+665/L</td>
<td>5.0</td>
</tr>
<tr>
<td>15307</td>
<td>5.0</td>
</tr>
</tbody>
</table>
These scale values reflect great variation in the progress that Pakistani WUAs have made toward becoming "pakka" (i.e., brick strong) organizations. Most WUAs remain relatively weak, in effect, "paper" rather than pakka organizations. How quickly Pakistan’s WUAs will progress in terms of becoming sustainable catalysts for agricultural and rural development will depend on the ability of the Pakistani OFWM program to solve a number of sociological problems.

WUA members rarely, if ever, have sufficient time prior to W/C improvement or once the WUA is organized, to work out among themselves, assisted by outsiders where this would be helpful, the farmers' ranking of problems, the farmers' strategy for their WUA to deal with these problems, and the farmers' agenda of activities to be implemented by their WUA in conjunction with--prior to, during, and after--W/C improvement. Thus, as OFWM staff complete improvement of one W/C and move on to the next, recently improved W/Cs and their WUAs are, in effect, left to wander aimlessly without means to navigate or propel themselves toward sustainable development.

The underlying reason for this problem lies in the failure of the design of Bank-assisted irrigation projects to include an effective strategy, and to provide the necessary resources to implement that strategy, for WUAs to function as the farmers' own vehicle for investing and sharing in the benefits of development. Much work remains if WUAs are to evolve from short-lived "paper" organizations for improving W/Cs to self-sustaining organizations active in promoting agricultural and rural development.

If Pakistan's WUAs are to become sustainable catalysts for agricultural and rural development, not simply a temporary project implementation vehicle, changes are necessary. As detailed more fully in this volume, the areas of change offering the greatest potential for enhancing the developmental impact of WUAs include:

- Specific provisions in the provincial WUA Ordinances;
- Strategy for organizing and registering WUAs;
- Member farmer awareness of WUA obligations, rights, and powers;
- Managerial capability of local leadership;
- Official attitude toward WUAs;
- Coordination of OFWM with adaptive research and extension;
- Training of WUA chairman, officers, and members in:
  -- On-watercourse research and extension; and
  -- Training simulation;
- WUAs as multifunction organizations;
- WUAs as revenue-collecting agents;
- Federation of WUAs; and
- Private sector support for development of WUAs.

How can the process of working with WUAs be improved under the OFWM program? What is needed is a broader concept that emphasizes:

- Establishment of firm criteria to be followed in selecting the specific W/Cs on which the OFWM program will work;
Commitment to:

- Building viable WUAs as the program's primary objective, not simply as a formality that needs to be met in order to proceed with W/C improvement, and
- Using W/C improvement as one of the means to build viable WUAs (rather than organizing WUAs as a means to improve W/Cs);

Accelerated implementation of ways and means to raise the level of farmer awareness, knowledge, and understanding of the purpose, functions, and powers of a WUA as set forth in the WUA Ordinances;

Provision of technical assistance/training to help WUAs to:

- Identify and rank problems according to priority;
- Formulate strategies to deal with selected problems;
- Design an agenda (program) of activities to work on selected problems; and
- Leverage the collaboration of agri-support institutions (e.g., credit providers, input suppliers) that are essential to implementing the WUA's program agenda.

There are two areas where the attitudes of the Government of Pakistan and the provincial governments contribute to or impede development of WUAs. The first is whether officials view the OFWM program as a vehicle to improve W/Cs or to develop WUAs. If an OFWM Field Team organizes a WUA solely to expedite improving a W/C, thereafter losing all contact with the WUA, the WUA is likely to wither regardless of how active it may have been during W/C improvement. But if the team provides follow-up services to the WUAs that have improved their W/Cs, this will stimulate continued WUA development.

The second whether officials perceive the development of WUAs as a divisive force that would enable the associations to make inappropriate and political demands on the federal and provincial governments. Where this perception is present, one may question whether the agencies having responsibility for implementing assistance to WUAs would be willing to organize and empower WUAs to federate and challenge the authority of the Provincial Irrigation Department and other agencies. On the other hand, officials may view WUAs in a more positive light, perceiving that farmer involvement in decisionmaking will lead to greater equity and efficiency in irrigated agriculture. This latter view is reflected in the Bank-assisted Command Water Management Project (Cr. 1487-PAK) that envisions developing the role of WUAs to include:

- Membership of a WUA on Subproject Coordination Committees to afford farmers a voice in the decision-making process;
- Registration of a WUA as a Cooperative Society, thereby making the WUA eligible to receive group loans from the Cooperative Bank;
- Organization of WUA Federations along minors and distributaries; and
- Involvement of WUAs in providing non-water inputs to members.
The OFWM program has tried various means to provide technical support in agriculture to farmers after W/C improvement (e.g., establishing a 1-acre demonstration plot). But followup technical support has not proven effective for such reasons as lack of coordination, personality clashes, interdepartmental jealousy, insufficient budgeting of resources needed to support field programs, and inadequate project design. Most probably, however, the problem continues to exist because the parties who are in a position to solve it have yet to meet and agree on a strategy on which they are willing to commit themselves. Specifically, the problem is one of finding effective ways to integrate adaptive research and extension into the OFWM program. Farming systems research and extension (FSR/E) models being adapted in many developing countries provide a potential solution, namely, to build a systematic adaptive research and extension capacity based on the farmer's traditional practice of informal experimentation (trial and error). This can be accomplished by providing the Provincial Agriculture Department a mandate and sufficient resources to field adaptive research and extension teams to work collaboratively with the OFWM Field Teams and WUAs in planning and implementing on-W/C adaptive research and extension tailored to the agricultural problems of greatest concern to an WUA’s members.

Donors are concerned that WUAs are not effective in motivating members to continue to clean and maintain W/Cs after improvement. Yet the data indicate that the technology involved in improving the W/Cs effectively reduces the frequency of maintenance and cleaning that farmers perceive as being needed. In effect, the W/C improvement technology successfully introduced by the OFWM program may carry with it the unintended consequence of reducing the incentive for farmers to take group action, be it through a traditional "khal committee" or a modern "Water Users Association," to clean and maintain their improved W/Cs. While the problem of conveyance losses in a W/C and the desire of farmers to increase the quantity of water available to irrigate their fields act as strong incentives for farmers to form a WUA to improve their W/C, the OFWM program's technology for improving W/Cs effectively reduces the need or incentive farmers originally had to work together to clean and maintain their W/Cs. Further, the ease with which the W/C now is cleaned has led some WUAs to establish systems whereby farmers individually clean assigned sections of the W/C at a time convenient to each farmer rather than requiring all farmers to clean the W/C collectively at the same time.

Thus, WUAs will be active and viable in the long run only if their members perceive that their WUA provide a way to achieve other desired objectives, beyond W/C improvement and maintenance, that farmers cannot individually achieve. The opportunity for WUA members to participate in an on-W/C adaptive research and demonstration program can provide farmers one incentive to motivate them to continue supporting and participating in their WUA. Of course, this incentive may not be the most attractive inducement for some WUAs. But incentives need not be limited only to technical assistance for adaptive research and demonstration activities. A WUA's members are likely to be quick to identify other problems on which they would like their WUA to work, such as registering the WUA as a Water Users' Cooperative Society, thereby opening the door for the WUA to obtain group loans from the Cooperative Bank; installing and operating a WUA-owned TW on the W/C; or taking taking on responsibility as revenue-collecting agents.
Some have argued that multifunction WUAs would be stronger than single purpose WUAs. But successfully managing a multifunction organization place much greater demands on an organization's members than a single function organization. Existing WUAs often have not even had adequate orientation and training to ensure their ability to function as single purpose organizations. To attempt to convert such organizations into multipurpose organizations, expecting that they will be able to run before than can even walk, almost guarantees that the "new" WUAs soon will collapse under the weight of their new responsibilities. The WUAs need opportunity to act on options that, if successfully implemented, will enable them to move toward becoming viable multipurpose organizations. The box below presents a potential sequence of options that, if successfully adopted by a WUA, could progressively develop the WUA as a multipurpose organization. But the specific sequence of activities around which farmers will have greatest incentive to support their WUA will vary from one WUA to the next, and should be determined for each case.

**A Potential Sequence for Development of WUAs in Pakistan**

- WUA is formed to improve and maintain W/C and improve operation of the water management system (e.g., an improved warabandi schedule to provide more timely delivery of water to meet crop requirements for moisture);
- WUA participates in an ongoing on-W/C adaptive research and extension program;
- WUA reorganizes into a Water Users' Cooperative Society, with eligibility for the Society to receive a group loan;
- WUA invests own/borrowed capital in revenue-generating or possibly "no profit/no loss" ventures (e.g., installing and operating a W/C tubewell or a holding reservoir);
- WUAs along a distributary and/or canal join in a federation to undertake group action to clean and maintain distributaries;
- WUAs in a region join into a Regional Water Users' Cooperative Marketing Society to pool farmer produce and capture scale benefits in marketing selected agricultural commodities; and
- Regional Water Users' Cooperative Marketing Society begins wholesaling agricultural inputs (e.g., fertilizers) to member Water Users' Cooperative Societies who, in turn, retail the inputs to member farmers.

It would not be wise to attempt to structure development assistance to force feed a preconceived sequence of options on WUAs. Assistance should be structured so that participating agencies have the flexibility to assist WUAs in implementing the most appropriate sequence of options given each WUA's circumstances. One approach to achieving flexibility would be to establish a "special projects" program that would receive proposals submitted by WUAs and make grants, on a merit basis, to those WUAs proposing technically sound, economically viable, socially feasible, but most of all, innovative adaptive research or revenue-generating projects.
1

WUAs: THE SOCIAL BRANCHES OF PAKISTAN’S IRRIGATION SYSTEM

Introduction

A growing body of literature documents the role of farmer organizations in irrigation management and agricultural development (cf. Byrnes, 1985; Uphoff, 1986; Cernea, 1985:23-118; and Cernea and Meinzen-Dick, 1987). Irrigation per se is a major input to agriculture in regions where the evapotranspiration potential exceeds the moisture level available from rainfall. While physical factors determine the rainfall amount received by a region, the flow of water, albeit from rainfall or groundwater, through an irrigation system to a farmer’s field depends not only on the system’s physical structures (e.g., ditches) but also, and more importantly, on the system’s social structures that facilitate the construction, operation, and maintenance of the physical structures. In an irrigation system, canals or branches physically convey water to farmer fields. But it is the system’s social structures or "social branches" that ultimately determine how productively the water flowing through the system will be managed. These "social branches" may be traditional forms of farmer organization or more contemporary forms such as the Water Users Associations (WUAs) of Pakistan.

This study focuses on one of the world’s major irrigation systems, that of Pakistan, and how the social branches (WUAs) of this system contribute—or could contribute more fully—to this country’s agricultural development. Over the past decade, more than 11,000 WUAs were organized in Pakistan. This report provides the first systematic documentation of Pakistan’s experience with WUAs. The report is based on field research conducted by the author in the summer of 1987 on watercourses (W/Cs) of three Pakistan provinces [Punjab, North West Frontier Province (NWFP), and Sind]. The field data were supplemented by secondary data from the literature as well as information drawn from files of the World Bank. The report is illustrated by vignettes drawn from case studies of 11 WUAs—6 in Punjab and 5 in NWFP (Box 1). These 11 case studies and supplementary case studies on Sind WUAs are presented in a separate report on file with the World Bank.

Box 1. Location of the 11 WUAs Studied in Punjab and NWFP

<table>
<thead>
<tr>
<th>Watercourse</th>
<th>Village</th>
<th>Tehsil</th>
<th>District</th>
<th>Province</th>
</tr>
</thead>
<tbody>
<tr>
<td>134,812/R</td>
<td>Parnawan</td>
<td>Chunian</td>
<td>Kasur</td>
<td>Punjab</td>
</tr>
<tr>
<td>27025/R</td>
<td>Virgar</td>
<td>Kabirwala</td>
<td>Khanewal</td>
<td>Punjab</td>
</tr>
<tr>
<td>51170/L</td>
<td>Chak 66GB</td>
<td>Jaranwala</td>
<td>Faisalabad</td>
<td>Punjab</td>
</tr>
<tr>
<td>5201/R</td>
<td>Chak 270/JB</td>
<td>Jhang</td>
<td>Jhang</td>
<td>Punjab</td>
</tr>
<tr>
<td>24879/L</td>
<td>Chak 605/TDA</td>
<td>Kabirwala</td>
<td>Muzapar Ghar</td>
<td>Punjab</td>
</tr>
<tr>
<td>20174/L</td>
<td>Jawingsing</td>
<td>Kabirwala</td>
<td>Khanewal</td>
<td>Punjab</td>
</tr>
<tr>
<td>73483/L</td>
<td>Masro Khel</td>
<td>Peshawar</td>
<td>Peshawar</td>
<td>NWFP</td>
</tr>
<tr>
<td>Shergay</td>
<td>Sandasar</td>
<td>Charsadda</td>
<td>Peshawar</td>
<td>NWFP</td>
</tr>
<tr>
<td>22675/R</td>
<td>Khoshmaqam</td>
<td>Nowshara</td>
<td>Peshawar</td>
<td>NWFP</td>
</tr>
<tr>
<td>7+665/L</td>
<td>Kanewar</td>
<td>Charsadda</td>
<td>Peshawar</td>
<td>NWFP</td>
</tr>
<tr>
<td>15307</td>
<td>Naira Umarzai</td>
<td>Charsadda</td>
<td>Peshawar</td>
<td>NWFP</td>
</tr>
</tbody>
</table>
The remainder of this chapter provides an overview of Pakistan's irrigation system, traditional types of irrigation systems, and how W/C maintenance traditionally has been organized. The ensuing chapters review the history of WUAs (chapter 2), the WUA model (chapter 3), WUA performance (chapter 4), and WUA sustainability (chapter 5).

Overview of Pakistan's Irrigation System

Approximately 90 percent of Pakistan's irrigated land, some 34.5 million acres, is served by the Indus Irrigation System, the world's largest contiguous irrigation system, comprising a network of rivers, dams, barrages, link canals, main/branch canals, distributaries, and W/Cs. Initially constructed by the British, the system has been developed and expanded over the past 100 years. Annually over 100 M acre feet (af) of surface water are diverted from the Indus River and its tributaries for irrigation. Traversing about 63,000 kilometers and commanding about 14 million hectares of cultivable area distributed across more than 89,000 W/Cs, of which about 54,000 W/Cs lie in Punjab Province. In addition to the canal system, there are about 200,000 tubewells (TWs) installed in the public and private sectors. These TWs pump about 36 M af of water. This water not only augments the canal water but also irrigates exclusively more than 3 M ha.

Consistent with the system's large size, Government of Pakistan (GOP) agricultural policies from the 1950s through the 1970s stressed large water sector projects (Tarbela and Mangla Dams, link canals, and salinity control and drainage projects). But policies stressing such large water sector projects neglected other agricultural development requirements, including irrigation system water management and operation and maintenance (O&M).

This scenario began to change in the late 1970s. The GOP's Five Year Plan (1978-83) stated, "A substantial beginning will be made on improved water management in the system as a whole, as well as on the farms." The Plan allocated Rs. 928 M to improve some 8,600 W/Cs and undertake land levelling on about 415,000 ac. The draft "Revised Action Program (RAP) for Irrigated Agriculture" (May 1979), prepared by the Water and Power Development Authority (WAPDA), proposed a strategy to increase agricultural production through programs and projects to rehabilitate the existing irrigation system (deferred maintenance); to improve water management; to turn over public TW operation to farmers; to strengthen irrigation and agricultural agencies; and to eliminate subsidies for fertilizer, pesticides, and TWs. In 1980 the National Board for Irrigated Agriculture Planning & Development basically adopted the RAP recommendation.

Management responsibility for Pakistan's irrigation system is split between WAPDA (manages the system's large, multi-purpose storage reservoirs) and each province's Provincial Irrigation Department (PID) (manages distributing water to the system's lowest order commands, chaks). There are approximately 90,000 chaks, varying from 200 to 700 ac (avg. 450 ac), each covering about 20 to 50 farms (avg. 35). Water flow in a chak distributary system (W/C) is governed by an open outlet (mogha) that self adjusts in proportion to the amount of water flowing in the distributary feeding the chak.
The planned water discharge from a mogha varies from 1 to 3 cubic feet per second (cfs). Water is distributed in a chak according to a rotational system called warabandi, in which each farmer holds a specific irrigation time proportional to his land holding. Traditionally water was diverted to various branches of a W/C by constructing earth dams at junctions, and to farm fields by making a cut (kachna nakka) in the W/C's bank. The chak boundaries and alignment of the sarkari khal (communal section of W/C) as well as the officially-sanctioned warabandi schedule (nakka warabandi) are established in each province by the PID.

Over time, "deferred maintenance" led to the deterioration of the distribution system above the mogha level. The GOP began to address this problem in the Irrigation Systems Rehabilitation Project, assisted by an IDA credit (Cr. 1239-PAK) and USAID cofinancing. But by the late 1960s the distribution system below the mogha level (i.e., W/Cs) had deteriorated to a "sorry state of affairs," resulting in excessive delivery losses, thereby causing farmers in a W/C’s mid and tail reaches to receive considerably less than their planned water share. Typically, W/Cs were laden with silt; overgrown with weeds, grass, shrubs, and trees; and subject to excessive spills because of weakened banks, rodent damage, and pilferage. As W/Cs traditionally were not brick- and cement-lined, farmers suffered numerous water management problems, including water losses (because of downward percolation of water in sandy soils); waterlogging and increased water table heights (because of inadequate downward percolation of water in heavy or clay soils and lack of adequate drainage facilities); and salinity because of the system’s inability to adequately flush salts.

Traditionally, responsibility for constructing, operating, and maintaining the sarkari khal and a chak's other irrigation channels lay with the farmers. The 1863 Canal and Drainage Act provides sanctions for the PID to ensure adequate W/C maintenance by farmers but these sanctions rarely were enforced. Faced by the advancing deterioration of 90,000 W/Cs, several hypotheses were advanced to account for the "sad state" of the W/Cs and farmers’ failure to manage water more efficiently. Key factors hypothesized included inattention by PID officials, inability and/or unwillingness of farmers to participate in W/C O&M, and strained relationships between farmers and PID officials.

Types of Traditional Irrigation Systems

There are several types of irrigation systems in Pakistan, with some variation by province. The predominant irrigation system in Punjab and Sind is the gravity-fed Indus Irrigation System. In this system, designed and built by the British, farmers are accorded the right to draw canal water for a period of time proportionate to the amount of land they own, with each farmer having an assigned warabandi turn. The actual amount of water that a farmer receives during his turn varies depending on the amount of water in the distributary feeding water to the W/C.
Over time some farmers began to obtain additional water from publicly- or privately-owned TWs to supplement the canal water they already received. Where farmers did not already receive canal water, the water supplied from a publicly-owned TW became the farmer's first irrigation water source. In either case, water was allocated to farmers according to the warabandi system. But farmers who draw water from privately-owned TWs are not restricted to receiving water only during their warabandi turn. Indeed, a farmer who owns a TW, or can purchase water from a farmer who owns a TW, has the greatest flexibility in terms of being able to supply water according to the needs of his crops rather than according to the quantity of water available during the farmer's warabandi turn (Lowdermilk, 1986).

In contrast to Punjab and Sind, three irrigation system types exist in NWFP. In the first type, the water source is canal water gravity fed to W/Cs as in the Indus Irrigation System. This canal water derives from sources such as the Swat and the Kabul rivers. The water source in the second system type is canal water lifted by a pump from a river and which then flows by gravity to the W/Cs. Both systems, from the source through the distributary that conveys water to the mogha at the head of each W/C, are publicly owned and government operated. The third type, although called the civil canal system, is a privately-operated system. The system originally was built and continues to be maintained by farmers. In this system, river water is diverted into a canal that delivers water by gravity to W/Cs. This system type is built and maintained by the farmers whose lands lie on the W/Cs receiving water from the civil canal. In each system, a PID-sanctioned warabandi schedule exists.

**Traditional Organization for W/C Maintenance**

Irrigation water is essential for sustaining agriculture in much of Pakistan. Farmers cannot afford to let silt and weeds choke off the water flowing through the W/C to their fields. Farmers must clean and maintain their W/Cs to ensure an unimpeded flow of water to their crops. But cleaning and maintaining a W/C is a task beyond the capability of any one farmer, a task accomplished only if farmers cooperate in some organized manner. Examples of the ways in which farmers traditionally organized for W/C maintenance were reported by farmers at each W/C visited. The traditional W/C maintenance patterns are described here for two illustrative WUAs (134,812 in Punjab and Sherogay in NWFP). These patterns may vary slightly from one W/C to the next.

**Punjab**

The farmers of W/C 134,812/R traditionally relied on a committee of farmers to organize cleaning and maintenance of the khal. This committee, which did not have any special name (but is referred to here as the "khal committee"), was comprised of three to four elite members of the village, including the village headman serving as the committee's chairman. Committee members had larger parcels of land. They were respected by the farmers and, thus, were able to influence them.
The khal committee was active in organizing farmers for khal cleaning and maintenance and in settling disputes over water use or other village disputes. The time decided by the committee for cleaning the khal was determined by the level of silt and weeds in the W/C. As the silt in the W/C increased, the flow of water to farmers’ fields was reduced. Either a farmer brought the problem of reduced water flow to the attention of a committee member or the problem was recognized by a committee member. Then the committee members would meet, decide on a date to clean the khal, and inform the village drummer to pass through the village, beating his drum and informing farmers in a loud voice of the day when they should come to clean the khal.

The customary procedure for organizing farmers to work on khal cleaning was as follows. Generally, the committee or its representative divided the khal into sections (e.g., from mogha to first turnout, from there to second turnout, etc.). Within each section, farmers were assigned a distance to be cleaned proportional to the acres of land they owned, the distance increasing or decreasing based on the work load (amount of silt and weeds), sub-sections being assigned in sequence of the farmers’ warabandi turns. When a sub-section had a heavy silt deposit, farmers would be assigned to work in pairs. Once farmers finished their assigned sections, they were free to go home.

According to this system, all the farmers on the W/C participated in cleaning the first section from the mogha to the first turnout. Once this section was cleaned, the farmers would move to the next section (first turnout to second turnout). Farmers who received all of their water from the first turnout (i.e., those having a warabandi turn that did not depend on water flowing through the second section), had fulfilled their cleaning obligation on finishing the cleaning of the first section and were free to go. Farmers at the tail end of the W/C (i.e., those having a warabandi turn depending on water flowing to the last turnout) were required perforce to clean each section of the khal from the mogha to the last turnout.

Before W/C improvement, khal cleaning was a much more difficult task that needed to be done with greater frequency (20 times per year). A single farmer could clean only 50 meters (m) per day at the head of the khal to 90 m/day at the tail. Cleaning the khal required 30 to 45 persons working a full day, with the amount of cleaning required of each person being greater the closer the person’s land was to the W/C’s tail. Because of the magnitude of the task, the khal committee found it difficult to "get people out of their homes" on the appointed cleaning day. At times, the committee was obliged to stop the flow of irrigation water to the field of a farmer who refused to contribute or was delinquent in contributing his share of the work.
W/C Sherogay is on the civil canal system. Traditionally, this village had a 10-12 person committee that was responsible for W/C cleaning and maintenance. This committee, known as the zamindarano tanzeem, was headed by a farmer known as kalimashar. In this village, the current WUA chairman, Haji Khuaidad, is the kalimashar, a role inherited from his father. (Haji also is the kalomashar for the ten villages on the civil canal.) Haji, in his roles as kalimashar (head of the zamindarano tanzeem) and kalomashar (leader of the zamindarano tanzeem of 10 villages), would meet with other village elders and decide when work needed to be done on the civil canal and/or the dam which diverted river water into the canal. Irrigation system maintenance was organized at three levels: W/C, civil canal, and river.

At the W/C level, cleaning was done about twice a year. The date for cleaning was decided in a meeting of the zamindarano tanzeem. Then the kalimashar appointed a respected village elder to inform villagers of the date. In recent years, this announcement also has been made on the loudspeaker of the village mosque. On the day set for cleaning the W/C, each household in the village sent one person to participate. The farmers, working collectively and supervised by the appointed village elder, would start at the canal outlet (kava) to the W/C, with all households participating in the cleaning of the main channel to the first turnout. Upon cleaning this first section, the farmers having fields irrigated by the first turnout were free to leave to clean the different sections on that turnout. The remaining farmers, having lands irrigated by the second and subsequent turnouts, then cleaned the section between the first and second turnout. On completing this section, farmers having fields irrigated by the second turnout were free to leave to clean the sections irrigated from that turnout. This process continued for each remaining section. It may be noted that, in this system, farmers were not assigned specific distances to be cleaned based on warabandi time or acres owned; nor were they assigned specific sub-sections based on the sequence of the warabandi schedule. This system, Haji recalled, was fairly effective as each household sent one person to help clean. If a household failed to send a person, that household was fined 20 Rs. per day. Haji remembered that, before W/C improvement, he regularly had to fine between 20-25 persons each year.

On the civil canal, cleaning was done each spring (April-May). The same system (as above) was followed. Farmers started cleaning at the head of the canal, working their way to the tail, all W/Cs being responsible to assist in the cleaning of the W/C from the river to the first W/C, at which point farmers with lands irrigated by the first W/C were free to leave. This cleaning task was organized by the kalomashar. At the river level, maintenance was conducted each August-September, when the river was low. In preparing for this work, the kalomashar called a meeting of the elders of the 10 villages. The elders decided on a day for the maintenance to begin, with the job normally requiring about three days. On the appointed day, some 500 (50 persons per village) came to the river, with each farmer bringing dam construction materials (e.g., logs, bags of soil). The farmers worked together in rebuilding the dam from inlet to civil canal out into the river.
HISTORY OF WATER USERS ASSOCIATIONS IN PAKISTAN

Evolution of World Bank Interest in WUAs in Pakistan

The World Bank’s interest in WUAs in Pakistan grew out of work supported by the U.S. Agency for International Development (USAID/Pakistan) during the early 1970s.

Research on Irrigation Efficiency

In 1973, WAPDA undertook a USAID/Pakistan water management research project at the Mona Reclamation Experiment Station (MRES). Repeated inflow-outflow measurements indicated that W/C conveyance losses ranged between 31%-57%. The greatest losses occurred in Salinity Control and Reclamation Project (SCARP) areas where W/Cs had not been adequately remodeled to carry the additional water provided by publicly-operated TWs. Subsequently, in 1976, MRES officials conducted a sample survey of 40 chaks in Punjab and Sind. The survey indicated that conveyance losses in sample W/Cs ranged between 35%-67%, with a weighted mean conveyance loss of 53%. The average irrigation efficiency (ratio of water stored in the plant root zone to chak water supplied) was 42%.

In 1977, WAPDA (under a UNDP-financed Bank water sector master planning project) made further measurements of chak-level irrigation efficiency on 61 selected W/Cs (Punjab, 35; Sind, 20; NWFP, 5; and Baluchistan, 1) during kharif (wet) and rabi (dry) seasons. The measurements showed that about 40% of the water entering W/Cs was lost before reaching farmer fields. Irrigation efficiencies were 37% for Sind, 42% (Baluchistan), 46% (NWFP), and 51% (Punjab), with little variation between kharif and rabi seasons.

Based on these inefficiencies and 1973/74 irrigation deliveries, these studies found that about 40 M af of additional water at the W/C inlet (mogha) would be needed to meet crop water requirements than at 65% efficiencies which could be attained via W/C improvements (e.g., limited lining) and better on-farm water management (OFWM) practices. While water deliveries at times exceeded crop water requirements, deliveries fell considerably short during peak demand periods. Another RAP study found that the per af cost of water saved through W/C improvement is 25% of the cost for developing new water supplies (Source: Internal Bank Document).

On-Farm Water Management (OFWM) Pilot Project

Based on MRES research on irrigation efficiency, and encouraged by farmer response to W/C improvement technologies developed at Mona, USAID/Pakistan and the GOP undertook a 5-year (1976-80) On-Farm Water Management (OFWM) Pilot Project, supported by an initial USAID loan of US$ 7.5 M in FY77. Project implementation responsibility was assigned to the Federal Water Management Cell (FWMC) in the Ministry of Food, Agriculture and Cooperatives. FWMC was responsible for coordinating project implementation by OFWM Directorates in each provincial-level Department of Agriculture.
The project’s 5-year physical targets were: (1) 1,530 W/Cs to be improved with compacted earth banks and limited (10%) hard material lining, and concrete control outlets (*pakka nakkas*); (2) 431,000 ac of land to be precisely levelled (plus or minus 2 cm deviation from avg. field elevation); and (3) 40,000 farms to adopt improved water management practices. Box 2 provides information on targets and actual accomplishments.

**Box 2. OFWM Pilot Project Planned Targets and Accomplishments (June 30, 1980)**

<table>
<thead>
<tr>
<th>Watercourse Improvement (no)</th>
<th>Nationwide</th>
<th>Punjab</th>
<th>Sind</th>
<th>NWFP</th>
<th>Baluchistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>1,530</td>
<td>900</td>
<td>510</td>
<td>100</td>
<td>20</td>
</tr>
<tr>
<td>Achievement</td>
<td>500</td>
<td>42</td>
<td>46</td>
<td>26</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Precision Land Levelling (ac)</th>
<th>Nationwide</th>
<th>Punjab</th>
<th>Sind</th>
<th>NWFP</th>
<th>Baluchistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Target</td>
<td>431,830</td>
<td>250,000</td>
<td>144,000</td>
<td>25,000</td>
<td>12,500</td>
</tr>
<tr>
<td>Achievement</td>
<td>45,056</td>
<td>23,064</td>
<td>17,979</td>
<td>3,422</td>
<td>591</td>
</tr>
</tbody>
</table>

Source: Internal Bank Document.

While actual accomplishments differed significantly from the planned targets, GOP officials were satisfied by the achievements because of four factors:

- The pilot nature of the project and numerous "start up" problems;
- Farmers’ enthusiastic acceptance of the project;
- Increased awareness in Pakistan of the need for water management; and
- Accelerated accomplishments in the project’s latter years--as many W/Cs were improved (273) and land levelled (20,000 ac) during FY80 as in the project’s first three years.

The OFWM Pilot Project included an innovation that farmers would supply all unskilled labor for construction of civil works, while the GOP would supply all materials and technical assistance, and would give a 50% subsidy for precision land leveling (PLL). Actual field work to improve W/Cs was carried out by field teams supervised by PID engineers assigned to the OFWM Directorates. Further, training institutes were established in Punjab (Lahore), Sind (Hyderabad), and NWFP (Peshawar) to provide training to OFWM personnel and officials of cooperating agencies. Also, the University of Agriculture at Faisalabad offered a 4.5 month training program for Agricultural Officers (AOs) and for instructors at each provincial training institute.

Although the Pilot Project successfully involved farmers in improving W/Cs, the project faced several problems, the principal one being that improved W/Cs deteriorated because of inadequate O&M by farmers.
**Punjab Accelerated Watercourse Cleaning**

Viewing the time involved to spread benefits from the Pilot Project to all chaks, the Government of Punjab launched in 1980 a "crash program" for heavy cleaning of W/Cs. About 9,800 W/Cs were cleaned and, by April 30, 1980, 7,500 Cooperative Societies had been organized on cleaned W/Cs as a mechanism for financing installation of pakka nakkas. The Bank for Cooperatives provided the Societies with credit for installing pakka nakkas (Rs 250 per installation), while the GOPunjab paid the cost of the pakka nakkas (about Rs 60 each) and the loan interest charges. In the end, however, pakka nakkas were installed in only 150 heavily-cleaned W/Cs, this in part because technical responsibility for installing the pakka nakkas had not been assigned to any one agency. The Bank found that the workload associated with the lending program proved excessive. Because adequate provision had not been made for maintenance, the heavy cleaning benefits were estimated to last no more than two years.

**World Bank-assisted On-Farm Water Management Projects (OFWM-I and OFWM-II)**

While the USAID-financed OFWM Pilot Project was scheduled to terminate on December 31, 1981, the funds available for civil works construction had been exhausted by April of that year. Further, faced by the possibility of USAID economic assistance to Pakistan being phased out entirely, the GOP requested IDA assistance in financing continuation of W/C improvement work started during the OFWM Pilot Project. In response to this request, IDA, the International Fund for Agricultural Development (IFAD), and the GOP agreed to a new 3-year (FY82-84), US$ 80M On-Farm Water Management (OFWM) Project (Cr. 1163-PAK) to be implemented in all four Provinces.

The institutional arrangements of the project (known as OFWM-I) generally were the same as for the Pilot Project, except that OFWM-I had an innovative requirement. As a condition for project assistance to the farmers on a W/C, a formal Water Users Association (WUA), registered under Provincial Ordinance, had to be organized on that W/C prior to project-financed improvements involving installation of permanent structures. The requirement entailed two related conditions: (1) that each province establish a legal ordinance providing for organization and registration of WUAs at the chak level; and (2) that project-assisted W/C improvements could not begin until farmers on a W/C organized themselves into a registered WUA.

**Types of Watercourse Improvement**

Basically, OFWM-I promoted two W/C improvements: (1) more permanent regular technology (pakka lining estimated to last 18 years); and (2) a relatively short-lived accelerated improvement technology (katcha or earthen) works estimated to last 6 years. The first improvement, Regular Technology, was aimed at about 2,000 W/Cs. This improvement, with an estimated 25% savings of water supplied to each chak, entailed rebuilding the sarkari khal (comprising 20% of the W/C length and nearly 85% of the channel usage) with clean, compacted soil. This would be followed by an average of 15% of the sarkari khal in fresh groundwater (FGW) zones and 30% in saline groundwater (SGW) zones being lined with brick masonry or concrete to reduce water losses and/or channel deterioration.
The higher percentage of hard lining permitted for SGW zones was to address the problem of irretrievable losses of deep percolated water, whereas percolation losses in FGW zones become available for subsequent pumpage from groundwater storage. As a further check on water losses and/or channel deterioration, *pakka nakkas* would be installed (about one for each 10 ac) at junctions and authorized outlets. Finally, about four culverts would be installed at major crossings in each W/C; also, check/drop structures and a limited number of buffalo baths would be installed as required. Box 3 lists the criteria to be used by field teams in selecting the *chaks* to be improved, and within a *chak*, the reaches of the *sarkari khal* to be lined.

**Box 3. Socio-economic and Technical Criteria for Selection of W/Cs to be Improved in the OFWM-I Project**

**Socio-economic Criteria**—In selecting W/Cs to be improved, preference was given to *chaks* with high potential for increased land and irrigation water productivity—*chaks* located in saline groundwater (SGW) areas or fresh groundwater (FGW) areas without access to TW water, and to those *chaks* cultivated by low income farmers. The field teams used the following criteria:

- Formally organized and registered WUAs (required prior to installing *pakka* structures); and
- Willingness of the farmers to improve their own W/C branches and to maintain improvements.

This improvements on farmer’s branches were to be initiated prior installing any *pakka nakkas*. The Provincial OFWM Directorates were assigned the responsibility of installing the *pakka nakkas*; and were to install them in a W/C only after a WUA had been organized and registered, and the Directorate had approved the quality of completed earthwork. Areas were to be chosen where groups of 5 to 10 W/Cs could be improved at one time to increase the efficiency of the field teams and reduce transportation costs. The selection criteria were to be revised based on the findings of the project’s socio-economic evaluation.

**Technical Criteria**—In selecting the reaches of the *sarkari khal* to be lined, field teams were concerned with identifying sections:

- Having excessive water losses because of high seepage rates (permeable soils) and/or high usage;
- Passing through villages or other heavily trafficked areas;
- Determined to be unstable because of elevation or soil conditions; and
- With severe siltation problems.

These criteria would generally identify head and village sections as needing lining.

Source: Internal Bank Document.
The second improvement, Accelerated Watercourse Improvement, aimed at 16,500 W/Cs, entailed heavy W/C cleaning and installation of structures, to rapidly spread water management benefits to a maximum number of farms. Estimated water savings were 6%-8% of the water supplied to a W/C, depending on the quality of the cleaning, followup maintenance, and total pakka nakkas installed. Specific improvements included desilting channels; removing brush and vegetation from banks; strengthening, straightening, and raising banks; restoring a uniform channel cross-section; and restoring deteriorated junction areas.

Other major project components, as described in Box 4, included precision land levelling (PLL), demonstration plots, training, financing of ongoing administration and coordination staffs, and local and expatriate technical assistance.

Box 4. Other Major Project Components in OFWM-I Project

**Precision Land Levelling (PLL)** would be deemphasized in this project because of (a) the impracticability of leaving land fallow on small farms, and (b) the shortage of federal and provincial funds to sustain the subsidy level provided under the Pilot Project. The cost of PLL on any one or more farms benefitting from this activity was to be paid in full by the benefitting farmers; however, the project would provide technical assistance and the OFWM Directorates would make land levelling equipment available on a rental basis.

**Demonstration Plots** on renovated W/Cs to show farmers improved water management practices and effective use of the increased water supply resulting from W/C improvement. Each renovated W/C would contain a 1 ac demonstration plot (except in Sind where a plot was planned for about every 20 W/Cs).

**Training** of all project personnel plus the chairman or designated member of each participating WUA. In this latter respect, a curriculum was to be developed for training Water Management Supervisors (WMSs) and Field Assistants on organizing and assisting WUAs, and for training WUA officers. WMSs were to be agronomy graduates (BS or MS) trained in water management, extension, and organizational techniques in a 4-1/2 month course at the University of Faisalabad.

**Financing of Ongoing Administration and Coordination Staffs** associated with the phased-out Pilot Project plus additional staffs in the Federal Water Management Cell (FWMC) and Punjab OFWM Directorate to accommodate the increased workload associated with the project; and existing field teams plus additional provincial-level field teams.

**Local Technical Assistance** in the form of supervisory consultants to assist the FWMC and Provincial OFWM Directorates in supervising and monitoring progress and quality of work, handling administrative matters, and ensuring fiscal control.

**Expatriate Technical Assistance** (one full-time and five part-time) specializing in water management irrigation, irrigation agronomy, training, trickle irrigation, and evaluation.

Also, the project would include financing of research to improve technologies and concepts to resolve problems arising during project implementation; a local qualified research institution to evaluate the project; and additional transport, office, and survey equipment.
In late 1985, the GOP and IDA agreed to initiate a second OFWM project (OFWM-II) (Cr. 1603-PAK) with an estimated cost of US$ 57.8 M. While OFWM-II replicates the OFWM-I emphasis on organizing WUAS, OFWM-II works only with the first type of W/C improvement (i.e., Regular Technology). The second type (improvements estimated to last only six years compared with Regular Technology improvements estimated to last 18 years), was less popular with farmers.

Responsibility for Organizing WUAs

Responsibility for organizing, registering, and maintaining liaison with WUAs under OFWM-I was assigned to the same OFWM Field Teams in each Provincial OFWM Directorate that previously had been responsible only for the physical improvement of W/Cs. OFWM-I also provided a Water Management Officer/Agriculture (WMO/A) who was given the responsibility of (1) encouraging WUAs to maintain their W/Cs after improvement, and (2) establishing a one-acre demonstration plot, on each improved W/C, to provide farmers demonstrations of how increased water supplies, efficient water management, and improved agricultural technologies could be most productively applied in farmer fields.

The most articulated model for linking the OFWM Directorates with the WUAs was in Punjab (see Box 5) where, at the time OFWM-I was being designed, poor O&M of renovated W/Cs was an ongoing problem in the USAID-assisted OFWM Pilot Project. Also, a measure of coordination and technical assistance (e.g., preparation of information bulletins) was to be provided at the federal level by the Water Management Wing, Ministry of Food, Agriculture and Cooperatives (MFAC).

A brief description of the organization of a Punjab OFWM Field Office (Faisalabad) provides an idea of the type of personnel assigned to an Area Field Team. The Faisalabad area office is headed by a Water Management Coordinator (Grade 18) who supervises nine Field Teams. Each Field Team includes a Water Management Specialist (WMS) (G-17), two Water Management Officers (WMOs)--Assistant Agricultural Engineer (G-17) and Assistant Agronomist (G-17), one Agricultural Officer (AO) (G-16), four Supervisors (G-11), and 2 Field Assistants (FAs) (G-6). All of the Field Team personnel received their professional training in engineering or agriculture. Moreover, the AO and FA personnel who are responsible for organizing WUAs and providing followup services do not have a budget to cover the costs associated with carrying out followup activities (e.g., establishing demonstration plots).
Box 5. The Proposed Model for Watercourse O&M in Punjab

The project was to establish an O&M section in the offices of the six area Deputy Directors of Punjab OFWM Directorate. Reporting to the Area Deputy Director through an Assistant Director (Agriculture) would be a Water Management Specialist (WMS) who would supervise five Field Assistants (FAs) posted by the Extension Service and who would come under the technical direction of the Punjab OFWM Directorate.

Each FA was to be assigned to 20 renovated watercourses (W/Cs). The main responsibilities of the WMSs and FAs were to be to: (a) organize formal WUAs; (b) serve as liaison between OFWM Directorate and WUAs to encourage their effective and continued operation; (c) monitor W/C maintenance and take appropriate action; (d) assist farmers and WUAs in planning, installing and operating simple irrigation practices; (e) schedule return of OFWM Field Teams to renovated W/Cs to do follow up work on further improvement (lining, structure installations, PLL, etc.); and (f) promote physical water management practices on the demonstration plot financed under the project. The Area Deputy Directors were to organize a disciplined approach whereby the FA would visit two W/Cs daily, making the rounds in a fortnight. Two days would be for specialized training, report writing, and leave. Also, a WMS would train and supervise each FA for one day during his weekly visits. During these weekly sessions the WMS would stress water management practices that should be emphasized by the FA.

Since there were fewer W/Cs to be renovated in Sind, NWFP, and Baluchistan, there was not sufficient justification for establishing a separate O&M section at the project's outset. But the three provincial governments had indicated that such an approach would be justified once their OFWM activities reached a certain magnitude. In the meantime, the WMS attached to the field teams in these three Provinces was to be responsible for coordinating and implementing the O&M activities discussed above and was to be given appropriate training in these matters.

Source: Internal Bank Document.

Statistical Picture of Growth of WUAs

Organizing WUAs has been a key part of all Bank-assisted projects having an OFWM component. These projects, in addition to OFWM-I and OFWM-II, have included SCARP Mardan, SCARP VI, Khairpur II, Fourth Drainage, Left Bank Outfall Drain, and Command Water Management (CWM). WUAs also were included as a component in the Asian Development Bank (ADB)-assisted OFWM Project. Table 1 provides a picture, by province over time, of the growth of WUAs in World Bank-assisted OFWM-I and OFWM-II Projects and in the ADB-assisted OFWM Project. Since 1981-82, when the provincial OFWM Directorates began to register WUAs, more than 11,000 WUAs have been organized and registered in Pakistan, 83% being registered in Punjab. The balance of the WUAs are in NWFP (9%), Sind (7%), and Baluchistan (1%). Table 1 provides a partial picture of the total number of WUAs organized and registered in Pakistan. Additional FWMC data show another 441 WUAs registered in Punjab, 216 WUAs under the 4th Drainage Project and 225 WUAs under the CWM Project. The CWM Project also has organized and registered WUAs in NWFP, Sind, and Baluchistan.
Table 1. Growth of WUAs by Province (1976-1987).

<table>
<thead>
<tr>
<th>Year</th>
<th>Punjab</th>
<th>NWFP</th>
<th>Sind</th>
<th>Baluchistan</th>
<th>Pakistan</th>
</tr>
</thead>
<tbody>
<tr>
<td>Informal</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1976-77 a/</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>6</td>
</tr>
<tr>
<td>1977-78 a/</td>
<td>98</td>
<td>3</td>
<td>9</td>
<td>0</td>
<td>110</td>
</tr>
<tr>
<td>1978-79 a/</td>
<td>214</td>
<td>8</td>
<td>55</td>
<td>0</td>
<td>277</td>
</tr>
<tr>
<td>1979-80 a/</td>
<td>700</td>
<td>32</td>
<td>140</td>
<td>0</td>
<td>872</td>
</tr>
<tr>
<td>1980-81 a/</td>
<td>589</td>
<td>55</td>
<td>114</td>
<td>0</td>
<td>758</td>
</tr>
<tr>
<td>Total</td>
<td>1,607</td>
<td>98</td>
<td>318</td>
<td>0</td>
<td>2,023</td>
</tr>
</tbody>
</table>

| Formal     |        |      |      |             |          |
| 1981-82 b/ | 920    | 67   | 42   | 0           | 987      |
| 1981-82 d/ | 121    | 42   | 0    | 0           | 163      |
| 1982-83 b/ | 1,942  | 46   | 170  | 0           | 2,158    |
| 1982-83 d/ | 280    | 133  | 0    | 0           | 413      |
| 1983-84 b/ | 2,036  | 81   | 122  | 0           | 2,239    |
| 1983-84 d/ | 357    | 163  | 0    | 0           | 520      |
| 1984-85 b/ | 1,285  | 73   | 117  | 0           | 1,475    |
| 1984-85 d/ | 266    | 131  | 0    | 0           | 397      |
| 1985-86 b/ | 405    | 33   | 10   | 18          | 466      |
| 1985-86 c/ | 436    | 54   | 162  | 12          | 664      |
| 1985-86 d/ | 268    | 90   | 0    | 0           | 358      |
| 1986-87 c/ | 1,014  | 51   | 155  | 75          | 1,295    |
| 1986-87 d/ | 95     | 66   | 0    | 0           | 161      |
| Total g/   | 9,425  | 1,030| 736  | 105         | g/ 11,296|

* Through December 31, 1985
** From January 1986 to June 1986
*** Through May 1987

a/ USAID-assisted OFWM Pilot Project
b/ World Bank-assisted OFWM-I Project
c/ World Bank-assisted OFWM-II Project
d/ Asian Development Bank-assisted OFWM Project
e/ Totals from Informal WUAs not included in totals for Formal WUAs
f/ Not registered and not included in totals for Formal WUAs
g/ This table provides only an estimate of the total number of WUAs
    that have been organized, since the table does not include WUAs
    registered under projects (e.g. Command Water Management Project)
    other than those identified in footnotes b/ to g/.

Source: Federal Water Management Cell, Government of Pakistan
THE WATER USERS ASSOCIATION MODEL IN PAKISTAN

The Water Users Association Ordinance

Evolution of the WUA Ordinance

While the earlier USAID/Pakistan-assisted OFWM Pilot Project (1976-80) relied on a traditional form of farmer organization ("khal committee") as a vehicle to mobilize labor to improve the W/C, these informal "water users associations" did not prove effective in motivating farmers to continue providing the labor needed to maintain the W/Cs after improvement. Studies of the OFWM Pilot Project experience led to the conclusion that the farmers on a W/C would only begin to take responsibility for maintaining their W/C after improvement if they were organized into a formal, legally-recognized Water Users Association (WUA) that was empowered to enforce W/C maintenance.

This conclusion provided the basis for the two conditions subsequently built into the OFWM-I Project: (1) that the GOP promulgate a WUA Ordinance to provide the legal basis for organizing a WUA on each W/C to be improved; and (2) that the farmers on a W/C be organized into a WUA before W/C improvement was undertaken. During the design of the OFWM-I Project, a draft WUA Ordinance was prepared and presented to Provincial Government officials as a model to be used by each province in drafting its own ordinance (Radosevich, 1975; Ministry of Food and Agriculture, 1978). In 1981, three Pakistani provinces (Punjab, NWFP, and Baluchistan) each promulgated its own WUA Ordinance (Government of NWFP, 1981; Government of the Punjab, 1981; and Government of Baluchistan, 1981). The Sind Ordinance was promulgated in 1982 (Government of Sind, 1982; Federal Water Management Cell, 1987a).

Provisions of WUA Ordinance

The intent of the provincial WUA ordinances was to empower farmers, through their WUA, with the authority and responsibility to operate and maintain their W/Cs after improvement. Generally, the WUA ordinances permit forming a WUA when 51% of the farmers receiving benefits from irrigation organize into a WUA and apply for registration with the Provincial OFWM Directorate.

The general purposes of a WUA are to provide farmers:

1. A vehicle for carrying out construction and operation and maintenance (O&M) activities within an association's jurisdiction, normally, a chak's watercourse (W/C);

2. A collective voice in decisionmaking regarding the planning, construction, and operation of irrigation and drainage facilities; and

3. A mechanism for conveying irrigation-related extension information.
Although there is some variation from one province to the next in how the provincial-level WUA ordinance is written, each ordinance generally provides for:

- Organizational procedures including adoption of by-laws;
- Membership;
- General assembly of users;
- Voting requirements;
- Election of a board of directors (or executive committee) along with powers and duties of the board;
- Powers of association in respect of adopting a schedule of fines, levying assessments, borrowing funds, acquiring lands, and contracting for water;
- Resolution of disputes;
- Provision for the WUAs to organize into a federation of associations along a distributary or canal;
- Sanctions if an individual association member fails to adequately maintain communal W/C improvements; and
- Recognition of the authority of the OFWM Directorates to undertake maintenance where individual WUA members or the association itself have failed to do so, and to assess the member or WUA for the costs incurred.

Based on the WUA Ordinance, WUAs generally are empowered to:

- Improve, rehabilitate, operate, and maintain W/Cs;
- Improve water supply from surface or groundwater sources;
- Locate, own, operate, and maintain TWs and lift pumps;
- Upgrade farm ditches and field outlets;
- Encourage adoption of OFWM practices;
- Establish water delivery schedules and supervise water allocation and distribution;
- Conscript labor for emergency repairs;
- Locate, initiate, and maintain drainage facilities;
- Remove obstruction in W/Cs during realignment, and operate and maintain W/Cs; and
- Ensure all members get their share of water in a timely manner.

**Comparison of Provincial WUA Ordinances**

Compared with the original draft WUA Ordinance, there are significant differences between the provincial ordinances (Byrnes, 1991). Generally, the NWFP WUA ordinance is identical to the original draft ordinance and is considered by Bank officials to be the best of the four provincial ordinances. By contrast, there are some major weaknesses in the Punjab and Sind ordinances.
Compared with the Draft WUA Ordinance, the Punjab WUA Ordinance does not set forth the purpose, functions, and powers of the WUA beyond its role in W/C improvement and maintenance. Nor is there provision for federating WUAs at the distributary and canal levels. The ordinance states that the "decision of the [OFWM] Field Officer granting or refusing to grant registration [of a WUA] under the Ordinance shall be final and shall not be called in question in any court or before any authority." Unlike the corresponding provision in three other provincial ordinances, Punjab farmers are given no right of appeal. The Punjab WUA Ordinance makes no provision for WUAs to have authority and responsibility for improving the drainage of water from the W/C and the land irrigated by the W/C. Finally, the Punjab WUA Ordinance is weak in terms of empowering Punjabi small farmers. The ordinance seems to have been designed almost solely to meet the Bank’s requirements (1) that the farmers on a W/C must first be organized into a registered WUA before the OFWM Field Team commences its work to improve a W/C, and (2) that a WUA and its members be legally responsible for the W/C’s maintenance after improvement.

While the Sind WUA Ordinance includes a provision for the federation of WUAs along minor and major canals, the ordinance does not include a provision for a landlord’s tenants (haris) to be members of the WUA in which the landlord is a member (and also most likely the chairman). In Sind, the ordinance defines the "water user" as "a person who enjoys the facility of irrigation water from a watercourse for the agricultural land owned or possessed by him and, in case more than one person jointly own or possess the land, any one of them authorized by the others to act on their behalf."

**WUA Member Knowledge of WUA Ordinance**

There is no value in having a WUA ordinance unless potential beneficiaries (farmers) know and understand their rights and obligations under the ordinance. But in all of the WUAs visited, only two WUAs were encountered where a WUA official had read the province’s WUA ordinance (5117/L in Punjab and 385-1A in Sind). Generally, WUA members have never heard (i.e., do not know of the existence) of their province’s WUA ordinance (27025/R, 24879/L, and 20174/L in Punjab, and 73483/L, 22675/R, and 7+665/L in NWFP) or, if they have heard of their province’s WUA ordinance, have never seen or read it (134,812/R and 5201/R in Punjab, Sherogay and 15307 in NWFP, and 5170/R in Sind). How might a farmer learn about his province’s WUA ordinance?

Each province’s ordinance was published in that province’s Gazette (the official organ for publishing a new law) in English. While the Gazette may be purchased for a few Rupees, no instances were found where a WUA had purchased the ordinance. The provincial WUA ordinances also have been reprinted in English as a booklet by the Federal Water Management Cell (1987a) but the booklet’s distribution had not yet begun at the time of this study’s field work. One of the provinces (Punjab) reprinted its WUA ordinance in English in extension or public relations pamphlets [Water Management Programme Punjab, n.d.; Directorate General Agriculture (Water Management) Punjab, 1987]. But an English version of the ordinance is of no value to farmers who cannot read English.
An abbreviated WUA ordinance, in Urdu, appears in "A Training Guide for Extension Workers" (Federal Water Management Cell, 1987b). This publication, however, is not aimed at WUA members but rather, as the title implies, at extension workers. The Federal Water Management Cell (1987c) also published a "Diary 1987a" which was widely distributed (one per WUA). This diary contains one page which refers to the "Water Users Association Act 1981" and describes the "duties of Water Users Associations".

The writer did find, in Punjab, that every WUA, when registered, is given a register which contains the rules and by-laws governing the WUA and a copy of the ordinance in Urdu. Personnel at the OFWM Training Center explained that all literature in Pakistan is published in Urdu; thus, for example, non-English newspapers in Punjab are published in Urdu, not Punjabi. Thus, there is no precedent for publishing the WUA Ordinance in a local language such as Punjabi. Nor is it customary to translate the English version of an ordinance into a province's local language.

While the Punjab WUA Ordinance is not available in a farmer's local language but is available in Urdu in the register received by each WUA, most of the WUAs visited in Punjab, and also those visited in NWFP and Sind, either never had heard of their province's WUA ordinance or, if they had heard of it, never had seen or read the ordinance. Consequently, WUA members know of their rights and obligations under their province's WUA ordinance only insofar as these are set forth in the proforma WUA by-laws that OFWM Field Officers give to a WUA to expedite organizing and registering the WUA. This conclusion is supported by WAPDA's 1985 study of WUAs in the World Bank-assisted OFWM-I Project. Of 200 WUA members interviewed in 40 WUAs, 48% had no knowledge at all and 36% little knowledge of their WUA's by-laws, while 54% had no knowledge and 34% little knowledge of WUA member rights and obligations.

Methodology of Organizing WUAs and Improving Watercourses

A Model of WUA Organization and W/C Improvement

The methodology involved in forming a WUA and improving and maintaining an association's W/C entails a series of steps, as follows: awareness, interest, evaluation and group action, registration, improvement, operation, maintenance, and followup. While the specific sequence of events involved in organizing a WUA and improving a W/C can vary from one province to the next or even within a province from one W/C to the next, Box 6 lists the steps and responsibilities of the farmers and the OFWM Field Team. The speed at which farmers may move from first learning about forming a WUA to being registered and improving their W/C can vary from a few weeks or less to several months, depending on how aggressively the farmers and/or the OFWM Field Team pushes the process along.
Box 6. The Process of Organizing a WUA and Improving and Maintaining a W/C

**Awareness**
Farmers on a W/C become aware of the possibility of organizing a WUA and improving their W/C, because they discover that another W/C has been improved or is being improved, or are approached by an OFWM Field Team representative.

**Interest**
The representative visits the W/C to explain the W/C improvement program, its benefits, and the process of organizing a WUA. Relevant proforma (e.g., WUA by-laws, application form for registering the WUA, agreement for W/C improvement, etc.) are given to the farmers.

**Evaluation & Group Action**
Farmers discuss the pros and cons of organizing a WUA and improving the W/C, and select an Executive Committee (EC); the EC collects membership contribution (at least Rs. 2 per ha.); the Treasurer opens a bank account, deposits the membership contribution, and obtains a deposit slip; the EC completes application form for registering the WUA; and the EC submits the form and bank account deposit slip to the WMO.

**Registration**
The WMO issues a certificate of registration and a register book to the WUA.

**Improvement**
The OFWM Field Team visits the W/C to survey the W/C, prepare a W/C improvement design, and review the design with the EC.

The EC mobilizes unskilled labor and any additional cash required to improve the W/C (e.g., to hire labor beyond that voluntarily contributed by the WUA members or, as in Punjab, where the EC contracts masons and pays them directly; the cost of masons in the other provinces is covered directly by the OFWM Project.)

The WUA improves W/C under guidance of the OFWM Field Team:
- Where needed, farmers build alternate W/C (or sections).
- The farmers demolish the W/C (or sections thereof).
- The portion of the W/C that is to be katcha (earthen) improved is rebuilt.
- The pakka nakkas and other structures are installed.
- The pakka lining is installed.

**Operation**
Each farmer operates W/C irrigation system per warabandi schedule.

**Maintenance**
Farmers collectively clean and maintain W/C periodically.

**Followup**
The WMO/Agriculture maintains contact with the WUA after the W/C has been improved—encourages farmers to conduct periodic cleaning and maintenance of the W/C; organizes plots to demonstrate the benefits of improved water management; arranges for farmers on the W/C (e.g., EC members) to participate in one-day training courses on W/C maintenance and water management; and collects the required installment payments for repayment of a percentage of the cost of the construction materials (bricks, cement, gravel, and sand) used in improving the W/C. The required repayment varies from 10% to 30% depending on the specific province and project under which the W/C was improved.
During the process summarized in Box 6, if a farmer defaults on an obligation (e.g., required payments for materials), the amount owed can be collected by the Provincial Revenue departments from individual landowners in the form of land arrears. These departments also are authorized to collect fees, in a similar manner, for communal W/C improvements or defaulted maintenance undertaken by the OFWM Directorate.

**Structural Dimensions of Pakistani WUAs**

*The W/C as an Organizational Principle*

A WUA in Pakistan is organized around the W/C. Generally, there is one WUA per W/C and the farmers along this W/C share a common concern—obtaining more water. Consequently, the prospect of improving and maintaining the common resource (i.e., the W/C) in order to increase the amount of irrigation water available to each farmer generally provides most, if not all, farmers with an attractive incentive to organize themselves into a WUA. Further, although most farmers may not realize it at first, the existence of a WUA on each W/C along a distributary provides an organizational basis on which to develop higher-level organizational forms (e.g., a distributary federation of WUAs). In turn, the existence of a federation of WUA on each distributary along a canal provides the organizational basis on which to develop a canal federation of WUAs.

**Size of WUAs**

There are more than 89,000 W/Cs in Pakistan. The size of a WUA, in terms of number of members and hectares covered, largely depends on the size of the W/C served by the WUA. WAPDA, in its M&E study of 6,014 WUAs registered from 1981-82 to December 1984, classified the sample of 40 WUAs in Punjab, NWFP, and Sind according to the number of farmers receiving water during the warabandi, as follows—35% of the WUAs had 20 or less farmers, 30% had 21-40 farmers, and 27% had 41 or more farmers. The number of water users per WUA ranged from 5 to 125 and averaged 34.

For this study, 14 WUAs were visited—6 in Punjab, 5 in NWFP, and 3 in Sind. Table 2 provides a summary of the average number of members per WUA visited, the average ha commanded per W/C, and the average number of ha per WUA member. These data indicate that the number of members per WUA tends to be the largest in NWFP, followed by Punjab, with Sind having the fewest members per WUA. Many of the larger agricultural holdings in Sind tend to be owned by a relatively small number of persons (e.g., single family) and the Sind WUA Ordinance does not allow tenants to be members of the WUA. Thus, as in the case of one Sind WUA visited, the WUA had only four members (all of the same family). While the W/C also had 40 other water users, they were tenants and not allowed to be members of the WUA. (The adverse impact on W/C improvement of having a big land owner at the head of a W/C is illustrated in Box 7). Table 2 highlights the average ha per WUA member, this figure being highest in Sind (22.5 ha) and falling to 6.1 ha in Punjab and 3.2 ha in NWFP.
Box 7. A Watercourse in South Sind

W/C 2L in South Sind has not been the beneficiary of any W/C improvement. Yet Muhammad Nazir, a farmer owning 155 ac in the middle to tail reaches of this W/C, would very much like to see W/C improvements made on this W/C. Canal water is scarce and cannot be supplemented by groundwater as there are no TWs on the W/C and the groundwater is saline. Over the years, the water level in the distributary feeding this W/C has dropped, resulting in less water entering the W/C through the mogha. In turn, water moves slowly through the W/C resulting in additional conveyance losses.

There are some 16 shareholders (water users) on the W/C which commands about 1,250 ac. Farmers grow wheat, cotton, sugar cane, and some fodder crops. Generally, most farmers own 20-30 acres. Nazir sees one obstacle to W/C improvement, namely, an absentee landlord, a big land owner who has 600 ac at the head of this W/C and land on three other W/Cs. "If the big landlord were located at the tail," Nazir explains, "he would surely use his power and influence to ensure that more water reached the tail, and all farmers from the head to the tail would thereby benefit."

However, where the lands of a big and powerful landlord are located at the head of the W/C, he can easily draw all the water he needs, with tail enders accordingly receiving much less. Nazir reports that many tail enders are taking land out of production for lack of water or even leaving their farms to search for work in the cities. The small farmer who is a tail ender is particularly at risk if the big landlord takes so much water that the tail ender’s crops suffer severe water stress.

The head ender in this case, the big landlord, is not satisfied to draw water only during his warabandi turn. He has arranged for a constant stream of water to run to a small garden. Further he is growing some 200 trees on the right of way along the sarkari khal, thereby drawing additional amounts of unsanctioned water, and selling the wood once the trees mature. Small farmers have requested him to remove the trees but he ignores them. Individual small farmers, lacking a WUA or government support and backing of the authority of such an association, have no power or authority to sanction the big landlord’s infractions.

Farmers along the W/C are reluctant to rock the boat as many are very dependent on the mercy of the big landowner for loans or they fear his power or influence. Nazir has talked with this landowner about the benefits of W/C improvement and the role which the WUA can play in helping to bring about improved water availability on the W/C. The landlord qua head ender is not opposed to W/C improvements as long as he gets the same quantity of water. This, however, is part of the problem as he currently is able to draw more water than the amount this is sanctioned by the Irrigation Department, and W/C improvement with pakka lining would make water theft more difficult. The landlord, it is said, has paid money to the Irrigation Department official to ensure being able to continue to draw unsanctioned quantities of water.
Table 2. Summary of Average Number of Members per WUA Visited, Hectares Commanded per W/C, and Hectares per WUA Member.

<table>
<thead>
<tr>
<th>WUA Membership Statistics</th>
<th>Punjab (n=6)</th>
<th>NWFP (n=5)</th>
<th>Sind (n=3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avg. Members per WUA Visited</td>
<td>68</td>
<td>95</td>
<td>6</td>
</tr>
<tr>
<td>Avg. Hectares Commanded per W/C</td>
<td>417</td>
<td>310</td>
<td>135</td>
</tr>
<tr>
<td>Avg. Hectares per WUA Member</td>
<td>6.1</td>
<td>3.2</td>
<td>22.5</td>
</tr>
</tbody>
</table>

Source: Author's field interviews with WUAs.

By-laws of WUAs

Each province’s WUA ordinance refers to WUA by-laws. But there is variation among provinces in whether an ordinance requires a WUA to submit its by-laws to the OFWM Field Officer as a condition for WUA registration. Punjab’s WUA Ordinance specifically requires that a WUA submit a set of by-laws (written by the WUA or the standard proforma by-laws provided by the OFWM Department) to the field officer as a condition for WUA registration. But the NWFP and Baluchistan Ordinances state only that the WUA “shall...adopt by-laws” within 30 days of registration of the association, while the Sind Ordinance states that a WUA "may, with the approval of the [OFWM] Director, make by-laws; provided that the first by-laws shall be made within sixty days of its registration."

Given that farmers are simply not aware of the applicable WUA ordinance, the importance of a WUA having by-laws lies in the WUA having a document that sets forth the basic raison d’etre of the WUA. The proforma by-laws in Punjab describe, among other provisions, the purpose(s) and functions of the WUA, who is eligible to be a member and the membership application procedure, sources of association capital, role and size of the executive committee and responsibilities of committee members (president, vice-president, secretary, and treasurer), minimum frequency of executive committee meetings, and minimum frequency of general body meetings. While a WUA is required in Punjab to submit a copy of its by-laws as a condition for registering the WUA, there is little evidence that a WUA meeting this requirement is conversant with the content of the by-laws. Thus, the fact that a WUA submits a set of by-laws to the OFWM Field Officer does not mean that the members of the WUA know or understand the by-laws or that the WUA will subsequently function in full compliance with the provisions of the by-laws.
Executive Committees of WUAs

The WUA ordinances provide for each WUA to have some form of executive committee (EC) (e.g., chapter 4 of NWFP and Baluchistan WUA Ordinances). This chapter provides for a Board of Directors consisting of not less than five members, including chairman, secretary, and treasurer. Specific duties of the board and its members are set forth. The board is designated as responsible for carrying out the WUA’s by-laws. Specific board duties listed are:

1. Manage the association activities in delivery of water;
2. Develop a plan of WC operation, maintenance, improvement, and rehabilitation;
3. Supervise W/C construction and maintenance and other improvement activities;
4. Employ and discharge ditch tenders, collectors, and construction personnel;
5. Exercise emergency powers to repair W/C breakages;
6. Negotiate and contract with government agencies and other institutions for improvement programmes acceptable to the general body;
7. Serve as the communication link between government agencies in dissemination of information and all matters representing the views and requests of the Irrigators’ Associations;
8. Maintain the financial and organizational records of the association; and
9. Call [a] special meeting of the general body for any matter involving original expenditure and other important issues involving the general membership.

An important provision of the two ordinances is that "No member elected to the Board of Directors shall enjoy any benefits greater than any other member by virtue of his elected position." This provision precludes board members from charging or being compensated for services provided which the ordinance assumes board members will voluntarily provide.

The Sind WUA Ordinance provides for a Board consisting of not less than five of the members of the association "and not more than three official members as may be appointed by the Government." The ordinance requires that the board shall annually elect a chairman, secretary, and treasurer. Generally, the board has the same duties (items 2-8) as set forth in the NWFP and Baluchistan WUA ordinances.

In lieu of items 1 and 9 in these two ordinances, the Sind Ordinance empowers the Board to "carry out such duties as are entrusted to it by the general body" and to "act as executive authority of the association". The absence in the Sind Ordinance of item 1 of the NWFP and Baluchistan ordinances implies that the Sind Ordinance does not specifically empower the WUA to manage the association’s activities in delivery of water.
In contrast with the other provinces’ WUA ordinances, the Punjab WUA Ordinance does not set forth provisions concerning a board of directors. The ordinance does require that a WUA seeking registration shall include with its application "the names and other particulars of the office bearers of the Association" and that a WUA cannot be registered unless "the office bearers and members of the Managing Committee of the Association have been duly elected in accordance with the by-laws of the Association". More specific guidelines for the managing committee are set forth in Punjab’s proforma by-laws which state that the managing committee shall be comprised of not less than five and no more than nine members elected by the general body. Specific duties and responsibilities are prescribed for the president, vice-president, secretary, and treasurer. These by-laws also state that the managing committee shall meet at least once a month.

Field interviews with WUA members in Punjab and NWFP revealed that the level of activity of WUA executive committees (ECs) varies considerably across WUAs. The average EC in Punjab contained five to seven members comprised of a chairman, vice-chairman, secretary, treasurer, and one to three other members, while the range of size of ECs in NWFP was found to be much greater. Each WUA visited has an EC consisting of a different number of members (from 4 to 20). Generally, EC members were found to have been "elected" by a process of selection or consensus of the association’s member farmers and not by a formal election.

Aside from the issue of size of the EC, the leadership exercised by the EC plays an important role in determining how active a WUA will be. An indicator of level of activity is the frequency of meetings held by the WUA. This varied considerably among the Punjab WUAs visited, ranging from four times per month (WUA 27025/R), to two times per month (134,812/R, 51170/L), to one time per month (4201/R, 20174/L), to no set schedule (24879/L). On the other hand, the practice of holding meetings was found to be less prevalent in the WUAs visited in NWFP. One association (Sherogay) reported meeting twice each month, while another (7-665/L) meets only three to four times per year. Two associations (73483/L and 22675/R) reported meeting only as needed, while WUA 15307 reported that it did not meet at all except as the farmers informally met each evening in the village hujra. Such daily interaction of the farmers would, to a certain extent, obviate the need for regular WUA meetings.

The existence of an EC can facilitate interaction between government personnel (e.g., OFWM Field Team members) and the farmers as well as a two-way flow of information between farmers and government personnel. Also, the EC can exercise its authority and leadership role in organizing irrigation management (e.g., W/C cleaning) and other activities of interest to farmers. The role of the EC and the WUA in facilitating irrigation management and other activities on the W/C is examined in greater detail in a later section of this paper.
Bank Accounts of WUAs

The only WUA ordinance that requires a WUA to open a bank account as a condition for registering the WUA is the Punjab ordinance. Based on the information provided by WUA members in Punjab and NWFP, the practice of opening and maintaining a bank account is more established in Punjab than in NWFP. One WUA interviewed in Punjab (W/C 134,812/R) did not have a bank account, although the vice-chairman as acting treasurer was holding 500 Rs. The balance of the WUAs interviewed in Punjab reported holding bank accounts with deposits of varying sizes, as follows: 10-15 Rs. (20174/L), 200 Rs. (24879/L), 1,300 Rs. (27025/R), 2,000 Rs. (24879/L), and 3,700 Rs. (51170/L).

By contrast, WUAs in NWFP appeared less consistent in opening and maintaining bank accounts. Two of the WUAs (7+665/L and 15307) did not open their bank accounts until some time after their W/Cs were improved; in both cases, only 5 Rs. were deposited, indicating the likely purpose of opening the account as being merely a formality, since the respondents interviewed could give no reason for opening the accounts other than that an OFWM Field Officer had instructed them to do so. On the other hand, WUA 22675/R held a bank account still having the same 600 Rs. deposited at the time the WUA was formed. Another WUA (Sherogay) displaying this pattern holds a bank account with the same 10 Rs. deposited at the time the WUA was formed. While the remaining WUA (73483/L) visited in NWFP opened a bank account in the name of the WUA chairman, the account did not have any money deposited in it. But this WUA, recently registered as a Water Users Cooperative Society, had opened another account in the Cooperative Bank in which the WUA deposited 13,000 Rs. as share capital.

What it means to a WUA's members to have a bank account varies among WUAs. For some, having the bank account is merely a formality. For other WUAs, having money in an account represents a source of emergency funds available to the association (e.g., when major repair work is required on the W/C). At the same time, the WUAs visited did not evidence a desire to capitalize their association in terms of building up their bank account balance. Farmers frequently said that if the WUA is in need of money, then the association can raise the money from the members as needed. Generally, WUAs do not perceive the bank account as an investment. In this regard, most if not all of WUA accounts do not earn interest. Farmers seem neither cognizant nor worried that their money, not earning interest and sitting idle during a period of inflation and currency devaluation, has depreciated in purchasing power. Further, more than a few WUAs visited pointed out that they did not believe in earning interest as this is viewed as wrong by the religion of Islam.

Links with Agri-Support Institutions

Only a few cases were noted where a WUA had begun to link with agri-support institutions or assume an agri-support function (e.g., provision of production inputs). One of these functions is played by extension agents who facilitate the transfer of improved technology to farmers.
In the design of the OFWM-I Project, it was proposed that there would be two distinct programs to provide technical services to farmers: (1) OFWM would undertake all water-related engineering and physical tasks within a chak; and (2) the Agricultural Extension Service would be responsible for bringing all the non-structural water inputs and the non-water inputs together into an extension package. This would assure continued and improved operation of irrigation facilities within a chak under the supervision of the OFWM Directorate, while at the same time providing farmers opportunity to benefit from an integrated Agricultural Extension Service employing the T&V system. The OFWM Directorate would selecting the demonstration plot area and install all structural water management practices. On completion of these tasks, the Directorate would turn over supervision of the plot to the Extension Service (Source: Internal Bank Document).

Further, it was envisioned that the OFWM Area Deputy Director would arrange for monthly meetings, at the following levels, with Extension Service officials to encourage coordination and improve input services to the farmers and WUAs:

<table>
<thead>
<tr>
<th>Level</th>
<th>OFWM</th>
<th>Extension</th>
</tr>
</thead>
<tbody>
<tr>
<td>District</td>
<td>Deputy Director, OFWM</td>
<td>Deputy Director, Agriculture</td>
</tr>
<tr>
<td>Tehsil</td>
<td>Water Management Supervisor</td>
<td>Agricultural Officer</td>
</tr>
<tr>
<td>Union Council</td>
<td>Water Management Assistant</td>
<td>Field Assistant</td>
</tr>
</tbody>
</table>

Despite OFWM-I’s intentions to develop effective working relationships between OFWM and Extension personnel, little, if any, collaboration had developed between these two units of the Provincial Agriculture Department. Interviews with WUA officials and OFWM and Extension Service personnel in Punjab, Sind, and NWFP indicate that the OFWM program had yet to identify an effective model for involving the Extension Service. Potentially available extension personnel currently were not being systematically involved in developing and executing the OFWM program. The failure to establish an effective working relationship between OFWM and Extension, albeit both units are administratively based in the Provincial Agriculture Department, is an issue to be addressed.

An important tool in transferring improved water management practices is the demonstration plot. Both World Bank OFWM Projects (I and II) included provisions for establishing a demonstration plot on each improved W/C. In the case of Punjab, the OFWM Department has a policy of establishing such a demonstration plot on a W/C within one to two years of completing improvement of the W/C. Discussions with WUA officials in Punjab, however, revealed that a demonstration plot was never established or had yet to be established in three of the older WUAs visited (27025/R, 24879/L, and 20174/L).
At the same time, also in Punjab, demonstration plots were found to have been established in two WUAs--5201/R (cotton) and 51170/L (maize and rice). Indeed, in the latter case, the WUA reported that it had played an active role in the demonstration by inviting farmers to attend fields days at the demonstration site. And WUA 134,812/R, although a relatively new WUA (established under the CWM Project), reported that it already had set aside land for a demonstration plot.

A third area where WUAs can help farmers link with agri-support institutions is in marketing. No instances were found where a WUA had begun to provide or even to consider the possibility of providing assistance to members farmers in the marketing of their crops. Similarly, WUAs were not assisting members to gain improved access to production inputs. While a few WUAs expressed interest in the possibility of their WUA becoming active in this area, only one WUA in Punjab (134,812/R) was already buying inputs and selling them to the association’s members. This, incidentally, was the only WUA that collected membership dues on a periodic basis. While some of the money collected is used for W/C maintenance, the association’s vice-chairman uses the balance to make volume purchases of inputs (e.g., fertilizers) for distribution to farmers who paid their membership dues. Another instance where a WUA member was active in buying and selling inputs was encountered in the Sherogay WUA in NWFP. In this case, however, the association’s chairman mortgages his own land (25 acres) each season to borrow funds to buy fertilizer; he then distributes fertilizer to other farmers on the W/C and they repay him after the sugar cane harvest.

A fourth area where WUAs potentially can link with agri-support institutions is credit. None of the WUAs interviewed, with one exception, ever had obtained a loan from a bank and few WUAs express any interest in this possibility. The noted exception was in NWFP, where WUA of W/C 73483/L recently had been registered as a cooperative society and had been granted a loan for the next cropping season.

Several factors may account for the lack of activity of WUAs in linking with agri-support institutions. In part, the problem may be one of knowledge (information), perception, and attitude. WUA officials on W/C 20174/L (Punjab), for example, indicated that they saw the WUA’s responsibility as being limited to W/C improvement and maintenance. On the other hand, WUA members may feel that the individual farmer’s agri-support needs can be met adequately through existing institutions. Farmers in several WUAs pointed out that commercial banks will loan farmers (up to 11 ac) up to 10,000 Rs. per crop season for seed and fertilizer, interest free if repaid within 6 months. Also, where a cooperative society already exists in a village (as in the cases of WUAs 5201/R and 24879/L in Punjab and 22675/R in NWFP), farmers already have a potential source of interest-free loans. Also instances were encountered of WUA officials expressing a lack of familiarity with the procedures involved in a WUA obtaining a loan or getting the WUA registered as a cooperative society.
**Relationship with Provincial Irrigation Department**

To date, Pakistan's WUAs, comprised of the primary users of the irrigation water conveyed to W/Cs by the canal system above a *mogha*, have little or no control over the agencies responsible for operating and maintaining the canal system above the *mogha*. While the WUAs in each province have a good working relationship with the OFWM Directorate (located in the Provincial Agriculture Department), these associations have no direct link with the Provincial Irrigation Department (PID) responsible for operating and maintaining the provincial canal system above the *mogha*.

A WUA's primary contact with the PID is through the *patwari* (or ditch rider), the individual who assesses each farmer's water charges (*abiana*) based on his survey of the number of hectares of each crop grown by the farmer. Also, the *patwari* traditionally has been responsible for checking that farmers do not tamper with the *mogha* or steal water. The need for the *patwari* to play this role has been obviated by the WUA ordinance that assigns authority for management of the W/C to the WUA. Further, WUA members report that the installation of *pakka* lining and *pakka nakkas* and the subsequent reduction in water losses by seepage or theft has resulted in a reduction of conflict among farmers over water. They feel that they are now less vulnerable to having to deal with the *patwari*’s self-interested interventions.

The PID also has authority to sanction the *warabandi* schedule. Should the members of a WUA agree to change this schedule, they are required to have the new schedule sanctioned by the PID. Farmers may also approach the PID with complaints about shortages of canal water or a desire for the government to install a TW. However, in general, neither the farmers nor their WUAs have any say over the budget, staffing, or operation of the PID. To date, WUAs have not evolved or developed to the point (e.g., such as through federations) where they can exercise direct influence or control over the system on which they depend for the supply and delivery of canal water.

**Federation of WUAs**

At the time of the field work for this study, there were no instance where two or more WUAs had joined into a federation of WUAs. Interviews with WUA officials and members evidenced little or no recognition of the opportunity or need for WUAs to join into federations. This, in part, is because WUA members are not familiar with or cognizant of the existence or content of the WUA ordinance applicable to their province. However, while the NWFP, Baluchistan, and Sind WUA ordinances include provisions for federating WUAs, such a provision is lacking in the Punjab WUA Ordinance. The potential for federating WUAs will depend on a number of factors. Principal among these, in the short to medium term, will be the continued development and strengthening of WUAs.
Training of WUA Leaders

Continued development and strengthening of WUAs will depend, in part, on the initiative of farmers and WUA officials. But it also will depend on the quality and quantity of technical and financial assistance as well as training provided to support the development of WUAs. Each province's OFWM Directorate conducts short courses at its Water Management Training Institute to train OFWM personnel who, in turn, provide field-level training to WUA officers and members.

In Punjab, the Water Management Training Institute at Lahore has conducted water management training programs since 1981, as summarized in Table 3. Training courses for OFWM personnel focus on W/C design and improvement, PLL and farm layout, irrigation agronomy, and water management extension. The Institute also offers a one week course to train OFWM personnel in operation, maintenance, and followup assistance to WUAs. Training of OFWM personnel to work with WUAs was intensified in 1987 by a 16-day WUA Communication, Maintenance, and Management training course, attended by 17 participants from Punjab (3), NWFP (3), Sind (7), and Baluchistan (3).

Currently, OFWM personnel reach about 1,000 WUA members per year through one to three day OFWM short courses (Table 3). Course subject matter includes organization of a WUA, the WUA Ordinance, WUA rules and by-laws, procedures for W/C improvement and maintenance, cost recovery procedure, irrigation methods, and effective utilization of water and other inputs. From 1981-82 to 1984-85, OFWM personnel conducted at least 10 short courses per year for WUA chairmen and members, with the number of WUA members trained each year increasing from 759 to 2,015. While the number of field training courses for WUAs increased to 42 in 1985-86, the number of WUA members trained that year fell to 1,794. Thus, in the 5-year period covered by Table 3, while 8,316 WUAs had been organized in Punjab, only 7,301 WUA members received water management training, indicating that, on average, less than one farmer per WUA participated in a water management training course. Given an estimated average of 30 farmers per WUA in Punjab (data provided by Federal Water Management Cell), training at the W/C level has reached less than 3% of the water users in Punjab. This, in part, explains why so many WUA members do not appear to have any indepth understanding of their province's WUA ordinance.
<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>OFWM Personnel</strong></td>
<td></td>
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<tr>
<td>Water Management Officers</td>
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<td>5</td>
<td>39</td>
<td>6</td>
<td>58</td>
<td>108</td>
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<tr>
<td>Sub Engineers</td>
<td>177</td>
<td>172</td>
<td>96</td>
<td>100</td>
<td>28</td>
<td>567</td>
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<td>Agricultural Officers</td>
<td>9</td>
<td>0</td>
<td>22</td>
<td>47</td>
<td>33</td>
<td>111</td>
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<tr>
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<td>0</td>
<td>48</td>
<td>30</td>
<td>102</td>
<td>180</td>
</tr>
<tr>
<td>Other Field/Area Team Members a/</td>
<td>1</td>
<td>10</td>
<td>0</td>
<td>6</td>
<td>14</td>
<td>31</td>
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<tr>
<td>Professionals</td>
<td>13</td>
<td>32</td>
<td>38</td>
<td>17</td>
<td>43</td>
<td>143</td>
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<tr>
<td>Sub Professionals</td>
<td>10</td>
<td>30</td>
<td>150</td>
<td>40</td>
<td>30</td>
<td>248</td>
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<tr>
<td>WUA Members</td>
<td>759</td>
<td>1047</td>
<td>1686</td>
<td>2015</td>
<td>1794</td>
<td>7301</td>
</tr>
<tr>
<td>Total</td>
<td>963</td>
<td>1296</td>
<td>2079</td>
<td>2247</td>
<td>2104</td>
<td>8689</td>
</tr>
<tr>
<td><strong>Training Courses Organized</strong></td>
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<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Regular (8-12 weeks)</td>
<td>5</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>22</td>
</tr>
<tr>
<td>Short (1-4 weeks)</td>
<td>3</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>3</td>
<td>20</td>
</tr>
<tr>
<td>Field Training Courses for WUAs</td>
<td>11</td>
<td>13</td>
<td>11</td>
<td>10</td>
<td>42</td>
<td>87</td>
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<td></td>
<td>19</td>
<td>21</td>
<td>23</td>
<td>17</td>
<td>49</td>
<td>129</td>
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</tbody>
</table>

a/ Includes Water Management Coordinators, Water Management Specialists, Assistant Agronomists, and Assistant Engineers.

PERFORMANCE OF WATER USERS ASSOCIATIONS

Introduction

WUAs have played a key role in helping Pakistani farmers to improve their W/Cs. However, efforts to evaluate these projects have not placed primary emphasis on assessing the effectiveness of these WUAs. As noted in an internal Bank report, evaluation activities were to devote significant but "secondary" importance to assessing selected issues that could affect the project's eventual impact, including the role and effectiveness of the Water Users Association (WUA).

Initial efforts to evaluate the WUAs were made in WAPDA's Monitoring & Evaluation studies of WUAs in the USAID/Pakistan-assisted OFWM Pilot Project and the World Bank-assisted OFWM Project. While these studies raised important questions about the level of activity of WUAs after the improvement of a W/C, Bank officials maintained that the WUAs are "effectively carrying out required assignments in the IDA-assisted OFWM projects" (Fairchild, 1985:5). Indicators supporting this conclusion were:

- Physical progress in OFWM-I projects (see Box 8) approached 90% to exceeded 180% of the targets envisaged in the Staff Appraisal Report;
- Farmers were repaying in large measure the cost recovery of materials as agreed; and
- Organization of WUAs and subsequent requests for assistance far exceeded GOP and provincial capabilities.

Indicators of project effectiveness in meeting physical targets provide only a partial measure of WUA effectiveness. Such indicators do not provide a picture of how active a WUA was during W/C improvement or, once a W/C has been improved, how inactive a WUA may have become. Nor do such indicators provide information on the impact of W/C improvement on irrigation efficiency, farming practices, and economic benefits to farmers. Accordingly, this chapter focuses on the role and effectiveness of WUAs in irrigation management activities impacting on irrigation efficiency, farming practices, and economic benefits to farmers.

Benefits of Improved Irrigation Management

The purpose of involving a WUA in improving a W/C is not only to increase the supply of irrigation water to farmer fields but also to improve the quality of irrigation management practiced by farmers. Physical W/C improvements, when accompanied by improved irrigation management, lead to improved irrigation efficiency, farming practice changes, and increased economic benefits. Precise estimates of the benefits of W/C improvement and maintenance can only be obtained by carefully measuring the relevant variables for a representative sample of W/C shareholders. The following data, obtained through interviews with WUA representatives, indicate the benefits deriving from WUA participation in improving and maintaining their W/Cs.
Box 8. Project Achievements in OFWM-I Project (Cr. 1163-PAK) to 6/30/85

<table>
<thead>
<tr>
<th>Project Component</th>
<th>Unit</th>
<th>FY85</th>
<th>Total Project to 6/30/85</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Target</td>
<td>Actual</td>
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<tr>
<td>Regular Improvement</td>
<td>no.</td>
<td>880</td>
<td>860</td>
</tr>
<tr>
<td>Accelerated Improvement</td>
<td>no.</td>
<td>4,750</td>
<td>3,924</td>
</tr>
<tr>
<td>Water Storage Tanks</td>
<td>no.</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Precision Land Leveling</td>
<td>ac.</td>
<td>9,780</td>
<td>10,802</td>
</tr>
<tr>
<td>Demonstration Plots</td>
<td>ac.</td>
<td>1,036</td>
<td>817</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,945</td>
<td>3,137</td>
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<tr>
<td></td>
<td></td>
<td>21,250</td>
<td>19,652</td>
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<tr>
<td></td>
<td></td>
<td>37</td>
<td>68</td>
</tr>
<tr>
<td></td>
<td></td>
<td>46,530</td>
<td>44,976</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2,759</td>
<td>3,977</td>
</tr>
</tbody>
</table>


Irrigation Efficiency

For the farmers of W/C 27025/R (Punjab), improvement of their W/C reduced the incidence of water wastage routes such as silting, overtopping, leakage from rodent holes, and accidental and illegal breaches. Before improvement, the measured discharge from the mogha was 72 liters per second (lps) (at the head), 60 lps (middle), and 45 lps (tail); the measured delivery efficiency was only 62.5%. With improvement, the designed delivery efficiency is 85%. The potential increase in delivery efficiency is important as each farmer on this W/C is allotted only 17 minutes of irrigation time per acre of land owned by the farmer.

The impact of W/C improvement on irrigation efficiency is illustrated by the experience of the WUA’s chairman. Mohammad Akram, whose fields are located at the middle of the W/C, has 3.5 hours of irrigation time, his warabandi turn lasting from Tuesday at 12:00 p.m. until Wednesday at 3:30 a.m. Before W/C improvement, only two of Mohammad’s 11 acres could be irrigated with canal water during his warabandi turn, with the job requiring 2 persons to patrol the W/C. With improvement, Mohammad can irrigate 2.5 acres in the same time and needs only 1 person to patrol the W/C. This is a 25% increase in area irrigated and a 50% reduction in the labor required to irrigate.

Further examples of increased irrigation efficiency on this WC are provided by a farmer owning 20 ac at the tail of the W/C (warabandi turn lasting 7 hours) and another farmer owning 5 ac at the middle of the W/C (warabandi turn lasting 1 hour 19 minutes). Before improvement, the tail ender could irrigate only 4.5 ac during the 7-hour turn; after improvement, this farmer can irrigate 1 ac per hour or a total of 7 ac during the 7-hour turn (55% increase). The farmer at the middle of the W/C could only irrigate 1 ac during his turn (1 hour 19 minutes); after improvement, he can irrigate 1.5 ac (a 50% increase). Generally, farmers feel that it is the farmers at the tail of the W/C who receive the greatest benefit from W/C improvement.
Improvement of W/C 5201/R (Punjab) has, as farmers see it, reduced water losses and increased the water available to irrigate their lands. For example, the fields of WUA chairman Muhammad Bakar are located at the tail of the W/C. His warabandi turn lasts 7 hours from Monday at 11:00 p.m. to Tuesday at 6:00 a.m. Before improvement, he could irrigate only 1 out of 12 ac during 6 hours during which he needed 5 persons to patrol the W/C. Since improvement, he now irrigates 2 acres during the same warabandi turn and needs only 2 persons to assist in patrolling the W/C--one in the field and one along the katcha portion of the khal. Another farmer, who previously could irrigate only 3 ac during his warabandi turn, reports that he now can irrigate 4.5 ac.

Farmers on W/C 24879/L (Punjab) quickly realized that W/C improvement led to improved irrigation efficiency. They remember one piece of land (10 ac) that the farmers had never been able to irrigate before improvement; with improvement, it became possible to irrigate this same piece of land. One farmer reported that his fields are at the tail reach of the khal and that his warabandi turn is 5 hours (based on owning 25 ac). Before improvement, he was able to irrigate only 1 ac during the summer and not more than 2 ac during the winter. With improvement, the farmer can irrigate 2 ac in a 5-hour turn during the summer and more than 3 ac during the winter. Another farmer, located at the middle reach of the khal, has an 8-hour turn for 40 ac. Before improvement, he could irrigate only 2-3 ac and, when there were sandstorms, he couldn't irrigate even 1 ac because of the accumulated sand in the khal. After improvement, the farmer is now able to irrigate 4 ac.

Favorable reports on W/C improvement also were provided by farmers on W/Cs in NWFP. For example, the members of the WUA on W/C 73483/L recalled that they couldn't adequately irrigate their crops before improvement. Farmers often came up short on water, being able to irrigate a field fully only two out of three irrigations. The additional water made possible by W/C improvement is being used mostly to increase the amount of water received by a field, and that only a small amount of the water is used to increase the number of acres irrigated. Similarly, before improvement of W/C Sherogay (NWFP), one farmer reported being able to irrigate 1 ac in 1 hour; with improvement, he can irrigate 2 ac during 1 hour.

Farmers on W/C 134,812/R (Punjab) report that W/C improvement reduced water losses; as a result, they feel that they now get more water. One farmer cited that, before improvement, he could irrigate only 4 ac; with improvement, he can irrigate 5.5 ac. Another farmer reported needing about 3 hours of water flow to irrigate 1 ac, with the required irrigation time increasing to 4 hours as the katcha deteriorated over time due to silt, weeds, rodent holes, and other damage (illegal breaches). However, once the W/C had been improved, this farmer can irrigate 1 ac in only 2 hours 40 minutes; with khal deterioration, irrigation time increases by only 30 minutes to 3 hours 10 minutes. Table 4 summarizes the data provided by this farmer.
Table 4. Impact of Watercourse Improvement on Per Acre Irrigation Time in an Uncleaned and Cleaned W/C in the Punjab.

<table>
<thead>
<tr>
<th>Per Acre Irrigation Time</th>
<th>Uncleaned</th>
<th>Cleaned</th>
<th>Time Saved by Cleaning</th>
<th>Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before Improvement</td>
<td>4 hr</td>
<td>3 hr</td>
<td>1 hr</td>
<td>25%</td>
</tr>
<tr>
<td>After Improvement</td>
<td>3 hr 10 min</td>
<td>2 hr 40 min</td>
<td>30 min</td>
<td>16%</td>
</tr>
<tr>
<td>Saved by Improvement</td>
<td>50 min</td>
<td>20 min</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Savings</td>
<td>21%</td>
<td>11%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Farmer interviews on W/C 134,812/R in Kasur District, Punjab.

Impact of cleaning on irrigation time may be estimated by comparing per acre irrigation times before and after improvement. For this farmer on this W/C, before improvement, cleaning reduced the per acre irrigation time by 1 hr. (25% time savings), whereas on the improved W/C cleaning reduces the per acre irrigation time by only 30 minutes (16% time savings). On the other hand, the impact of W/C improvement on irrigation time may be estimated by comparing the per acre irrigation time before and after cleaning. Per acre irrigation time is reduced 50 minutes (21% time savings) if we compare the before and after improvement irrigation times on an uncleaned W/C, while per acre irrigation time is reduced only 20 minutes (11% time savings) if we compare the before and after improvement irrigation times on the cleaned W/C.

If the farmer's estimated irrigation times under these varying conditions are correct, the savings in irrigation time due to cleaning an improved W/C are not as great as the savings in irrigation time due to cleaning an unimproved W/C. This suggests that the farmer's return to cleaning labor measured in terms of reduction in per acre irrigation time on an improved W/C may be less than the return to cleaning labor on an unimproved W/C, particularly if the farmer takes into account the opportunity cost of allocating labor to employment alternatives (e.g., planting and irrigating more land, working off the farm).

The relationships summarized in Table 4 helps to explain why farmers may or may not maintain improved W/Cs to the extent that had been desired by OFWM Project officials and/or donors. The data support Levine's (1986:4) hypothesis that "the immediate costs associated with regular routine maintenance--financial, organizational and political--may not be balanced by the benefits from such maintenance, if one discounts the benefits for the time lag between incurring the maintenance costs and obtaining the benefits."
Farming Practices

As part of the OFWM-I Project appraisal, the World Bank developed estimates of the expected impact of W/C improvement on cropping patterns and yields in the project areas. Estimated cropping patterns, levels of input use, and yields were derived using the Development Research Center's Indus Basin Model. The data for the model were provided by a farm level survey of 2,000 farmers which WAPDA conducted in 400 chaks. With water availability as the main constraint to increasing cropping intensities, most project-induced increases in production were expected from increases in cropped area. The model also predicted increases in cropping intensities and shifts in cropping patterns, mainly toward higher valued crops requiring additional water. Finally, the model predicted that increases in water supply would bring improvement in input use and hence some increase in yields.

Of course, how farmers use the land available to them is not solely a function of the increased amount of water made available by W/C improvement. Other key factors include climate, market conditions (e.g., crop prices), input (e.g. fertilizer) availability and prices, and the level of technology practiced by farmers. However, on the W/Cs visited, increases in the amount of irrigation water made available by W/C improvement generally have enabled farmers to irrigate and plant more land, to increase cropping intensities, and to change cropping patterns, including planting of a greater variety of crops. But there are variations from one W/C to the next in this pattern.

On W/C 27025/R (Punjab), cropping intensity was reported to have increased from 60% before improvement to 100%-125% after improvement. While the increased availability of water made it possible for farmers to plant more land, farmers indicated that they had not changed their cropping pattern. They were continuing to grow wheat, cotton, and sugar cane. But some farmers had increased the amount of land planted to cotton. Also, farmers reported that they were not applying increased dosages of fertilizer; they felt this is not necessary since the improved flow of water, at non-silting velocity, enabled more silt to be carried directly to the fields, thereby reducing the need to apply fertilizer.

Farmers on W/C 51170/L (Punjab) also reported an increase in cropping intensity, with some farmers planting more sugar cane, a crop requiring more water than the farmers' traditional crops. But farmers did not report increased fertilizer use. Farmers on W/C 5201/R (Punjab) also reported a change in the cropping pattern, with more land being planted to rice and sugar cane. However, farmers reported increased use of fertilizers. When water was much scarcer, they never used fertilizers; now, with water being more abundantly available, the farmers feel that they can't get good yields unless they use fertilizer. Improvement of W/C 24879/L (Punjab) resulted in cropping intensity increasing from 80% to 120% as well as changes in the cropping pattern. Where farmers never grew cotton before improvement, cotton now is a cash crop. Use of production inputs also was reported to have increased. A farmer having 15 ac now applies 25 bags of urea where, before improvement, he applied only 18 bags.
Farmers on W/C 73483/L (NWFP) reported that, with W/C improvement, the area planted (or cropping intensity) increased only marginally (10%), with most of the additional water from W/C improvement being used to ensure that currently cropped fields were irrigated adequately. But the farmers were planning to increase the number of acres planted to vegetables such as okra or to orchard crops. On W/C Sherogay (NWFP), the increased availability of water during certain times of the year enabled farmers to begin to intercrop alfalfa with sugar cane. Other changes in the cropping pattern also had occurred. For example, farmers now can grow two crops of maize per year where, before improvement, they could grow only one crop. Thus, land now is used more intensively, a fact reflected in fertilizer dosages after improvement (4 bags per ac) compared with before improvement (2 bags per ac).

Farmers on W/C 22675/R (NWFP) traditionally cropped wheat, maize, and sugar cane. With W/C improvement, some farmers now intercrop tomato and cucumber with sugar cane. Increased amounts of fertilizer are being applied since farmers are using the land more intensively. Before improvement, farmers would apply 2 bags of fertilizer per acre; with improvement, farmers now apply 3 bags per acre.

**Economic Benefits**

Early Bank analyses of the Indus Basin noted that farmers in the region face severe water constraints and tend to underirrigate their crops; these analyses estimated that most near-term project benefits would come from increases in cropping intensities rather than increases in yields, although increases in water supply would bring about improved input use and hence some increase in yields. One should caution that attributing the economic benefits of increased water availability to W/C improvement tends to neglect the role that the WUA played in organizing and contributing to the W/C’s improvement. Further, farmers from one improved W/C to the next may vary in their perceptions regarding the benefits of W/C improvement. Box 9 provides examples from two provinces--Punjab and NWFP--of the economic benefits of farmers organizing into WUA and improving their W/Cs.

Another W/C improvement benefit not cited above has been that farmers, through their WUAs, have developed a feeling of farmer ownership of the W/C and the improvements made thereon. Also, the increased availability of water has reduced the element of physical and economic risk faced by farmers who are dependent on the irrigation system for the moisture needed to water their crops. By organizing in a WUA, farmers have begun to reduce institutional risk and improve their access to agri-support factors such as credit and inputs. Overall, farmers on most, if not all, W/Cs visited expressed that the W/C improvement program is the first and only government-sponsored scheme for the agriculture sector that has benefitted the farmer.

Punjab

- The main economic benefit of W/C improvement on W/C 134,812/R has been the increased area farmers now can irrigate. The farmers also are reaping a benefit in terms of higher net returns from a reduction in per unit production costs from increased irrigation efficiency.

- On W/C 27025/R, W/C improvement has been accompanied by a decreased labor requirement for W/C operation and maintenance, increased time between required maintenance, and increased water availability such that a farmer can irrigate more acres per warabandi turn and apply more water per acre.

- Farmers on W/C 5201/R report that, with increased water availability from W/C improvement, higher valued crops are being planted, fertilizers are being used, and yields and incomes have increased. Further, intensification of agricultural activity has required increased inputs of labor which are being met by putting previously unused family labor (brothers and children) to work.

- With improvement of W/C 24879/L, wheat yields increased from 5-10 to 10-20 mawn per ac. While increased production has meant that farmers now have a greater labor requirement in the field, they are happy about this. W/C improvement also has had an impact on gender roles as women now spend more time in the field picking cotton. The men joke that women traditionally spent too much time at home and that it is better that they pick cotton than sit at home. But they actually are saying that the return to family labor has been increased by having women take on the task of picking cotton. Thus, W/C improvement has increased employment options for women and the marginal return to family labor.

NWFP

- Farmers of W/C 73483/L report that wheat and maize yields (10-12 mawn per acre) were much lower prior to W/C improvement. With improvement, crop yields have climbed and farmers are now getting 40 mawn per acre of wheat and 30 mawn per acre of maize.

- On W/C Sherogay, land is being cropped more intensively and productively. Where farmers once called their crops "thin," they now refer to their crops as "thick." For example, sugar cane yields have increased from 2-3 to 4-6 tractor trolleys per acre. Wheat yields have increased from 20 to 40 mawn per acre. With improvement, on-farm employment for sugar cane has doubled and the average income per acre has risen from 4,000 Rs. to 9-10,000 Rs.

- Increase cropping intensity on W/C 22675/R has been accompanied by increased on-farm employment. Where farmers previously worked an acre with 8 persons, they now need 16 persons. The increased labor requirement is being met from within the village, either by family labor or daily wage labor (25 Rs. per day). Before W/C improvement, a farmer could earn 4,000 Rs. per acre from sugar cane; now, after improvement, he can earn an additional 4,000 Rs. by intercropping tomato or cucumber with the sugar cane.

- Farmers on W/C 7+665/L report that wheat yields have increased from 6-8 mawn per acre, while corn yields have increased 3-4 mawn per acre, without adding more fertilizer.
Irrigation Management Activities of WUAs

The irrigation management matrix (Figure 1) provides a framework for analyzing farmer organization and participation in irrigation management. This matrix includes 3 dimensions: (1) water user activities (to provide water to crops in an adequate and timely manner); (2) control structure activities (to manage the structures that give control over application of water to crops); and (3) organizational activities (to organize efforts to manage control structures). This irrigation management matrix was utilized to explore the extent to which Pakistani WUAs play an active role in providing water to crops in an adequate and timely manner, in managing the structures that give control over the application of water to crops, and in organizing the effort to manage these structures.

Figure 1. Matrix of Irrigation Management Activities (Uphoff, et al., 1985:6).
Water Use Activities

Management activities focusing on the provision of water to crops in an adequate and timely manner include acquisition, allocation, distribution, and drainage.

**Acquisition.** This first management activity concerns the acquisition of water from surface or subsurface sources, either by creating and operating physical structures such as dams, weirs or wells, or by actions to obtain some share of an existing supply.

On W/C 134,812/R (Punjab), the WUA had not helped farmers to acquire more water beyond that spilling through the mogha into the W/C. The W/C had no TWs but WUA members expressed interest in acquiring an electric TW. The WUA had discussed making a claim for a government-subsidized TW but had not moved to implement this idea.

Farmers on W/C 27025/R (Punjab) were supplementing canal water with TW water at 30 Rs. per hour. A farmer needs about 2 hours of TW water to irrigate 1 ac, at a cost of about 60 Rs. per ac. With W/C improvement, many of the W/C's 7 TWs were being used less than half the time. Thus, farmers were considering closing half the TWs but wanted to replace the old diesel motors (35,000 Rs. per motor) with electric motors (15,000 Rs. per motor). Farmers felt that the cost of improving the TWs would be justified, as diesel TW water was selling at 28 Rs. per hour, whereas electric TW water was selling at 15 Rs. per hour on other W/Cs. But the WUA had taken no action to help farmers to acquire more water.

On W/C 51170/L (Punjab), farmers wanted more water. One way to achieve this would be to increase the amount of water in the distributary that delivers canal water to the W/C's mogha. While the PID had responsibility for operating and maintaining the distributary and the canals feeding it, the WUA never met with representatives of the PID. The only interaction between the farmers and the PID had been individual farmer contacts with the department's patwari who assessed each farmer's abiana (water charge) based on acres of land irrigated and type of crop grown. While several farmers were in favor of the WUA owning a TW, the WUA had yet to take any action to bring this to fruition.

Farmers on W/C 73483/L (NWFP) had no TWs and wanted more water. WUA Chairman Samin Jan had tried to get the PID to act on farmer irrigation problems. Before W/C improvement, Jan visited the PID to voice the farmers' complaints about the shortage of water in the lift canal and to convey the farmers' request that the PID install a new pump and intervene to change the warabandi schedule. Since improvement Jan had visited the PID regularly about these problems. He also attended some of the World Bank-assisted CWM Project meetings, requesting that the percentage of allowed pakka lining be increased. But neither Jan nor his WUA had been able to acquire more water than that available to the farmers through improving their W/C.
W/C Sherogay (NWFP) provided a rare case where a W/C’s farmers had, through traditional group action, been active in acquiring water. This traditionally included cleaning the W/C and the civil canal as well as constructing and maintaining the dam that diverts water from the Swat River into the civil canal. But farmers wanted to have more water, particularly as there was no TW on the W/C. They wanted to install an electric TW at the W/C’s head. The WUA chairman had asked the PID, both before and after W/C improvement, for assistance to obtain a TW; however, no progress had been made on this request. WUA members suggested they could request government assistance to build a more permanent diversion structure in the river, since this structure washed away with every flood and continually needed to be rebuilt. But the WUA had taken no action on this possibility.

In contrast to the self-help attitude of WUA members on W/C Sherogay, other NWFP WUAs reflected a "depend on the government" orientation. While the farmers on W/C 15307 (NWFP) indicated that they needed more water, their WUA chairman (Mohammad) stated that the government should assist farmers in maintaining the W/C and providing further improvements (i.e., more pakka lining). Further, he expressed reservations about acquiring a TW. He asked: "Who will pay the electricity bill?" He felt that canal water is more fertile and productive than TW water and that the government should meet the farmer’s needs for water by increasing the water in the canals and distributaries. He reported that he once went to talk with the PID Sub-Divisional Officer (SDO) when there was a shortage of water in the canal; the SDO responded to the plea for assistance by stating: "What can I do when there is a shortage of water in the river?"

A similar dependency attitude was seen in visits with farmers on W/C 7+665/L (NWFP). As there were no TWs on this W/C, the W/C totally depended for irrigation water on government-supplied canal water. But the WUA chairman indicated that W/C improvement brought the supply of water to an adequate level and that there was no need for a TW. Yet the chairman pointed out that farmers would "pleasantly accept" having a TW if it were provided by the government, since "farmers could not provide it themselves." A similar tendency to depend on the government also was evident on W/C 22675/R (NWFP). A year before the farmers of the village had met to discuss the possibility of getting a TW. They agreed on the need for a TW and WUA vice-chairman Kamal applied to the PID for a TW. While the farmers offered to pay double abiana (water charges) on TW water, they felt that the government should be responsible for installing and operating the TW.

As these vignettes illustrate, beyond the WUA’s role in improving the W/C, these associations had not been active or effective in helping farmers to acquire additional water. An exception to this rule was reported for one W/C that was not visited (see Box 10).
Box 10. A WUA Tubewell in the Punjab

WUAs frequently express their interest in owning and operating TWs. Data are available on one W/C where a TW has been installed under a subsidy scheme sponsored by the Punjab Agriculture Department. The TW is supervised and operated by the W/C’s WUA. The W/C in question is 54300/L, Chak 138/TDA in the Tehsil of Layyah, Punjab.

This W/C was improved with pakka lining in 1981-82. Later the Agriculture Department allotted a low-speed diesel engine TW to the W/C’s WUA. The cost of installing the TW partially was borne by the WUA, with the government contributing 20,000 Rs., while 15,000 Rs. were contributed by the WUA’s members.

The TW was installed during 1982-83 near the mogha. Now the WUA runs the TW on a "no loss/no profit" basis. The WUA currently charges 18 Rs. per hour to cover the operating and maintenance costs, plus a 2 Rs. service charge to compensate the operator. Thus, farmers on this W/C are able to purchase TW at 20 Rs. per hour to supplement the canal water they receive during their regular warabandi turns. The cost of commercial TW water in the same area was reported to be 30 Rs. per hour. Thus, the WUA is helping the farmers to improve their access to water and to reduce their production costs per unit of output.

Source: Personal interview with OFWM field staff, Multan District, Punjab.

Allocation and Distribution. While allocation and distribution are distinct in the irrigation management matrix, they are related closely in Pakistan’s irrigation system. Allocation refers to the assignment of rights to users, thereby determining who shall have access to water, while distribution refers to the physical process of taking the water from a source and dividing it among users at certain places, in certain amounts, and at certain times.

In the Indus Irrigation System, each farmer on a W/C is a shareholder and is allocated a warabandi time (so many minutes of irrigation time) proportional to the number of acres owned. The amount of water available to be distributed during the farmer’s warabandi turn is determined by the amount of water flowing from the distributary through the mogha into the W/C on which the farmer’s land is located, less any conveyance losses between the mogha and the turnout to the farmer’s fields. Thus, if water in the distributary is reduced, the height of the water flowing through the mogha is correspondingly reduced and less water flows through the mogha into the W/C. This system automatically ensures each farmer receives roughly the same amount of water per acre, although farmers nearer the tail tend to receive a smaller share of water because of conveyance losses (e.g., seepage of water from the katcha).
Given the system’s design, there is little flexibility for the WUA to control water allocation (who has rights to water) or water distribution (who gets water when, where, and in what quantity). The warabandi schedule is not totally fixed, since in many areas it is rotated by 12 hours once a year, so that a farmer having his irrigation turn at night this year will have his turn during the day next year. Any change in the warabandi schedule under the current legal structure must be agreed to by the farmers and subsequently approved by the PID. While the WUAs visited were asked about their interest in the potential of modifying the warabandi schedule, farmers tended to express an unwillingness to change the schedule or the view that the WUA did not have sufficient authority to change the schedule.

Generally, the WUAs visited did not report conflicts over water rights or water distribution (i.e., warabandi schedule). However, two exceptions to this pattern were note:

- Farmers of the WUA on W/C 51170/L (Punjab) reported that the WUA had helped to resolve a minor dispute over water allocation and distribution. The case concerned two farmers, the one having a warabandi turn immediately following the other farmer’s turn. The first farmer set his watch by the clock on the mosque; however, the second farmer set his watch by another source. As a result, the second farmer started his irrigation turn 7 minutes before the scheduled time. A dispute arose over this matter and the problem was discussed in the WUA meeting. The WUA ruled that the second farmer would have to delay the start of his next irrigation turn by 7 minutes to compensate the first farmer’s loss.

- On W/C 5201/R (Punjab), a dispute arose about disruption of water flow during a farmer’s warabandi turn. A farmer’s water buffalo was sitting in the katcha section of the khal, blocking water flow to another farmer’s fields during the latter’s warabandi turn. The latter farmer complained to the EC which decided to fine the buffalo owner and pay the farmer who had lost the water. A fine of 15 Rs. per hour was fixed by the EC based on two factors—the water had been stopped for nearly two hours, and the price of TW water at the time was approximately 7 Rs. per hour.

Overall, W/C improvement technology had virtually eliminated the potential for conflict or disputes arising over water theft. While it was reported that numerous cases still were being filed in Pakistani courts over water disputes, the use of easily-operated pakka nakkas on improved W/Cs had eliminated any possibility of water loss from "accidental" breaches. But farmers on W/C 22675/R (NWFP) reported that disputes over when one farmer’s turn ends and the next farmer’s turn begins had increased since W/C improvement. Perhaps the ease with which the pakka nakkas can be closed and opened had made farmers more sensitive to whether farmers’ turns end and start precisely on time. This, in part, could be aggravated by farmers’ watches not being synchronized with the official time kept on the mosque clock. When this became an acute problem two years before, the WUA met to discuss it. One farmer proposed that all farmers set their time by the radio station but the farmers couldn’t agree to this solution and the problem continued without solution. This would indicate the fragile and limited authority and influence of the WUA on this W/C.
Drainage. Management of water drainage is important where excess water must be removed. All but two WUAs reported that the WUA had not been active with respect to drainage problems (e.g., waterlogging). Generally, farmers stated that the problem was not waterlogging but rather a shortage of water.

Control Structure Activities

Management activities focusing on the structures required for water control include design, construction, operation, and maintenance. To facilitate the analysis, design and construction are considered in terms of a more general activity termed "W/C Improvement."

W/C Improvement (Design & Construction). Improving a W/C entails two closely related irrigation management activities—design and construction. The first involves the design of dams, diversions, or wells to acquire water, of systems of rules to allocate it, of channels and gates to distribute it, and of drains to remove it. The second involves the construction of the structures to acquire, distribute, and remove water, or implementation of the rules that allocate it. WUAs had been active in W/C improvement, although the type and level of activity varied across WUAs.

On completing the survey of W/C 134,812/R (Punjab), the OFWM Field Team provided the WUA with a design and estimate of the cost for improving the W/C. In this case, farmers found no problems with the proposed design; thus, the WUA's EC did not have to resolve disputes regarding the proposed alignment, removal of trees, location of pakka nakkas, etc. Based on the cost estimate, the EC raised 10 Rs. per ac from the farmers on the W/C to cover the cost of hiring masons and paying laborers (e.g., where farmers could not or would not provide voluntary labor). During the period of improving the W/C, the team provided the EC with technical assistance. But the EC organized the labor for demolishing the old W/C and rebuilding the katcha or unlined portion of the new W/C. Here, the EC assisted in organizing a meeting of farmers to establish a schedule for improving the W/C. Once this decision was made, the village drummer informed the other farmers when they were to begin work. Further, the EC contributed to the construction phase by hiring masons, supervising their work, checking the quality of materials (e.g., brick), and monitoring the proportion of cement to sand used.

While improving W/C 27025/R (Punjab), several disputes arose over design issues. These involved the gains and losses of land associated with improving alignment. The farmers who felt that the new alignment resulted in loss of some land complained to the WUA's EC. The EC explained that if farmers did not contribute the required land, the work would stop and they would not gain the benefits of W/C improvement. Following this approach, the EC resolved a few cases; where it was not possible to resolve such disputes, the construction followed the original alignment.

Difficulties also were encountered on W/C 51170/L (Punjab) in getting the farmers to cooperate in W/C improvement. Some farmers were not in favor of the proposed alignment for the W/C, since this alignment entailed cutting trees that these farmers valued. Other farmers did not agree with proposed locations of pakka nakkas. Also, some of the farmers did not feel that they would have sufficient spare time to support the W/C improvement project. EC members went to the reluctant farmers and convinced them of the benefits of W/C improvement.
The WUA on W/C 51170/L (Punjab) was active during the time of construction, as it was during this time that farmers were contributing not only money to pay the masons but also their own physical labor to demolish the W/C and rebuild (earthen improve) the katcha section. Contributions were not limited to cash and labor; one farmer also loaned his tractor to assist with demolishing and improving the W/C. Other farmers paid for the gas for the tractor, above and beyond their regular cash and labor contributions. WUA chairman, Ansar Khan, indicated that the progress in improving this W/C was due in part to his leadership. As he stated: "In every village there is one fanatic who goes to any extent to help others." Where simple persuasion would fail, he and some other farmers had once stopped the flow of water to the land of a farmer who had refused to cooperate. The man quickly came forward and promised that he would cooperate.

At the time the OFWM Field Team conducted the survey of W/C 24879/L, the WUA’s EC worked with the team to identify the location of the pakka nakkas and other structures. All farmers were pleased with the design produced by the team. During the construction phase, the EC was active in supervising the masons’ work and the materials (e.g., bricks). Indeed, each EC member was assigned a specific task to supervise (e.g., checking that sand and cement were being mixed in the right proportions). Also, the EC assisted the farmers to organize the construction of a temporary, alternate W/C. The farmers reported that the EC tried to get masons to speed up their work; as farmers were contributing their own labor to implement the project, they were concerned that the masons (who were being paid 800 Rs. per 60m) work efficiently.

On W/C 73483/L (NWFP), WUA members reported that, during the time the W/C was being improved, the EC resolved disputes arising over the W/C improvement design and mobilized the labor and cash needed. Similarly, on W/C 22675/R, the EC was on top of the construction phase of the improvement; if any disputes arose, an EC member would try to resolve the dispute. For example, if a farmer was reluctant to remove a tree or could not afford to have it removed, the EC would pay for the cost of removing it.

The EC of the WUA on W/C Sherogay (NWFP) was active during W/C improvement. The EC did not feel that the OFWM design for W/C improvement was adequate. Farmers wanted more pakka lining than the allowed 15% length of the W/C. They also wanted more pakka nakkas. On three occasions, the EC petitioned the OFWM Department to increase the allowed percentage of pakka lining and the pakka nakkas. Through these petitions the EC got the number of nakkas increased from 32 (in the original design) to 62.

Generally, it is clear that a WUA, particularly its EC, is active during the period of W/C improvement. The EC plays an active liaison role between the farmers and the OFWM Field Team. Further, the EC plays a leadership role in mobilizing the needed resources (labor and money). The EC also supervises the construction work and plays an active role in helping farmers to resolve disputes or conflicts over the W/C improvement design and actual construction work.
Operation. This activity refers to the operation of the structures that acquire, allocate, distribute, or remove water according to some determined plan of allocation. Generally, based on the WUAs visited, it is clear that Pakistani WUAs currently do not play any role in the operation of the irrigation system. Here "operation of the irrigation system" is understood as including patrolling the W/C during a farmer’s warabandi turn as well as the physical work involved in diverting water from the fields of the farmer with the preceding warabandi turn to one’s own fields. Indeed, before W/C improvement, a farmer could only start his warabandi turn by closing the katcha below his turnout point, opening the katcha at the turnout point to his field, removing the katcha barrier built in the khal by the farmer with the preceding warabandi turn, and then closing the katcha at the turnout leading from the khal to the other farmer’s field.

The WUA does not play any role in system operation because the Indus Irrigation System, and the W/Cs in this system, were not designed to be operated on a demand basis. Rather the system was designed to be supply-driven, with canal water from the distributary continually flowing through the mogha into the W/C, each farmer with a predetermined warabandi turn (time). The role of the individual (as distinct from the WUA) in operating the irrigation system is illustrated by the warabandi time of Ghulam, WUA vice-chairman on W/C 134,812. Ghulam’s fields were located in the W/C’s middle reach; his warabandi time lasting 2 hours [Thursday (12:00 a.m.) to Friday (2:00 a.m.)]. Traditionally, the water flowing from the khal to Ghulam’s fields during his warabandi turn was sufficient to irrigate .75 ac out of a total of 4 ac owned by Ghulam, with 2 persons being required to operate the system (moving katcha to divert the water and patrolling the W/C). With improvement (installation of pakka nakkas), Ghulam could irrigate 1.125 ac with 1 person. The WUA played no role in operating the system itself.

This also was the pattern on W/C 27025/R (Punjab). Before improvement, one farmer required 4 men to patrol the W/C during his warabandi turn. After improvement, the farmer needed only 2 men, one to patrol the pakka-lined section, the other to patrol the katcha section. The ease with which the pakka nakkas can be moved makes it possible to send a child to redirect the water from one outlet to another. The farmers also report that women assist in operating the irrigation system (e.g., patrolling the W/C and moving pakka nakkas), which was not possible before W/C improvement because of the heavy labor of moving mud to check and divert the water flow.

Asked if the WUA plays any role in operating the irrigation system (e.g., hiring a person to open and close pakka nakkas), the farmers of WUA 51170/L laughed, saying that this actually is a funny question. As they noted, operating the irrigation system is now so easy, why would any farmer spend money to employ another farmer to do this job. But the chairman added that the WUA is playing a role in discouraging water theft. He reported that the farmers decided in one of their WUA meetings that, if anyone is caught stealing water, the person would be fined based on the amount of land irrigated and the type of crop of the person losing the water. Asked what the fine would be, the farmers replied that the EC had only mentioned an amount of 160 Rs. per acre to create fear about stealing water. So far, the farmers reported, there had been no water thefts since improvement of the W/C.
This pattern of WUA non-involvement in irrigation system operation also was seen on W/C 24879/L (Punjab). The fields of WUA chairman Ghoash Bashk are located at the middle of the W/C. Before W/C improvement, Ghoash irrigated 3 ac during his warabandi turn and required 4 persons to patrol the W/C (1 in the field and 3 along the W/C). After W/C improvement, Ghoash could irrigate 5 ac during the same turn and required only 1 person in the field and none to patrol the W/C. Thus, like the other farmers, Ghoash was operating the irrigation system on an individual basis and there was no perceived need for the WUA to play an active role in the physical operation of the irrigation system.

Turning to NWFP, the same pattern of WUA non-involvement in irrigation system operation was again observed in each of the W/Cs visited—15307, 7+665/L, 22675/R, Sherogay, and 73483/L. But irrigation system operation on W/C 73483/L was found to be facilitated by a traditional institution known as the munsif (justice). The munsif is a local villager who is given the responsibility for reminding each farmer this his irrigation turn is about to start. With the munsif paid by each farmer at the rate of 40 kg of wheat per 24 hours of warabandi time, there is an independent check to ensure that each farmer’s irrigation turn lasts only as long as the assigned warabandi time. The system reduces the potential for any one farmer to cheat.

These cases illustrate that, despite a WUA’s potential to play a more active role in irrigation system operation (e.g., the munsif could be an employee of the WUA), irrigation systems in Punjab and NWFP continued to be operated by each farmer during his warabandi turn. WUAs, as currently structured, were playing no role in irrigation system operation.

Maintenance. The final control structure activity is maintenance of water control structures. This provides for the continued and efficient acquisition, allocation, distribution, and drainage of water. The OFWM-I Project envisioned that the WUAs would be responsible for operating and maintaining improved W/Cs and that enacted legislation (WUA ordinances) would provide sanctions to ensure farmers maintained their W/Cs. All the WUAs visited in Punjab, NWFP, and Sind reported that, after W/C improvement, W/C cleaning was needed less frequently and that cleaning took less time and/or less labor.

The farmers of W/C 134,812/R reported that after improvement, they could clean the W/C in less time. A single farmer can clean 90 m per day at the head of the improved W/C to 120 m per day at the tail, this representing an average 42% increase in the distance which a single farmer could clean in 1 day. The pakka-lined section now needed to be cleaned only once every 3 months and can be completed in 1 day by 2-3 persons. Each time the pakka section needs cleaning, the EC of the WUA arranges for several persons to do the job, rotating the job among farmers to ensure that all farmers shared in this task. On the other hand, the katcha portion of the khal was being cleaned about once a month, with the traditional system for organizing the farmers for W/C cleaning still followed. But farmers having a warabandi turn not depending on water flowing through the katcha section (i.e., their turnouts are on the pakka section) did not contribute any labor to the cleaning and maintenance of the katcha section.
Overall, farmers estimated that they could clean the improved W/C in 25 person days compared with the 30 to 45 person days required for this same task before improvement. This represented a 17% to 33% reduction in the labor required to clean and maintain the W/C. About 1.5 years had passed since the W/C had been improved; in the interim, WUA members had cleaned the W/C about 6 times and mobilized an estimated average of 100 person days per year for khal cleaning. While farmers on the pakka-lined section of the khal now did not do any work on the khal’s katcha portion, the balance of the farmers were reported to be more willing to do W/C cleaning and maintenance than before W/C improvement. Farmers were aware that when the khal is clean, they receive more water. They also recognized that it became easier to keep the khal clean.

Further, if the EC announces that the khal is to be cleaned on a certain day and a farmer does not come, the EC investigates to learn why. If the farmer fails to have a good reason (e.g., illness), the committee will impose a penalty (e.g., an amount equivalent to what would be paid a laborer to work one day on cleaning the khal). The money is then given to a laborer or another farmer to do the cleaning in behalf of the delinquent farmer. If the farmer refuses to pay, the EC will arrange for the farmer’s next warabandi turn (i.e., the water thereof) to be sold to another farmer at the rate of 20 Rs. per hour, with this money going to the WUA.

Asked if the WUA handles this kind of problem more or less effectively than the village’s traditional committee for cleaning the khal, WUA vice-chairman Ghulam stated that the WUA has gained the confidence of farmers. They recognized that it was the WUA that arranged for the pakka lining of the W/C and the other improvements (e.g., culverts for traffic to cross the W/C). Further, the farmers could see that the WUA is dealing with real problems and that they could take their problems (e.g., family disputes or a village-level problem such as repair of a katcha road or maintenance of the mosque) to the WUA.

While the task of organizing khal cleaning on W/C 27025/R is not assigned to any one member of the WUA’s EC, any EC member can take the initiative to set a date for cleaning the khal. The procedure followed in cleaning the khal after W/C improvement is the same as that followed before W/C improvement. Prior to W/C improvement, the village cleaned the katcha every 2 weeks, each time mobilizing 50 farmers for three 6-hour days; a single man could clean only about 15 m per day toward the head of the katcha. After improvement, the pakka-lined section of the W/C required only minimal maintenance (30 persons in 3 hours and the job being done about once a month). The katcha section of the khal also needs to be cleaned about once a month but requires only 40 persons working one 6-hour day. One man can now clean about 105 m per day of katcha.

EC members reported that farmers, after W/C improvement, were more willing to clean the khal as they understood that the work is less, easier to do, and can be completed in a shorter time. Where a farmer used to work 3 days to clean the khal before improvement, after improvement he has to work 1 day and the job is done. Asked if there were any cases since W/C improvement where the EC sold the water of a farmer who would not clean the khal, an EC member replied that the threat of selling a farmer’s water usually suffices to motivate his cooperation, and that the EC had not had to make such threats since the W/C was improved.
Improvement of W/C 51170/L (Punjab) brought a change in the way farmers organize themselves to clean the W/C. The new system was the idea of the WUA secretary, Akram Khan, and was agreed to at a WUA meeting. Generally, the *pakka*-lined section doesn't need as much cleaning; the cleaning problem lies in the *katcha* portion. To clean the *katcha*, the WUA established a system in which each farmer is assigned a specific section. Each farmer is responsible for cleaning the section between the turnout to his fields and the preceding turnout. This WUA also established procedures to deal with farmers who do not clean their assigned section. If a farmer doesn't clean his section, that person is called to appear before the EC. In the event that a farmer does not appear, the EC goes to the farmer's home and tries to convince him of the need to keep the *khal* clean. If the farmer fails to comply, the EC stops the flow of water to the farmer's field during his *warabandi* turn. WUA chairman, Shabaz Khan, indicated that the EC stopped the water on four occasions and gave it to other farmers. Sanctioned farmers, Shabaz reports, now do their fair share of the cleaning.

On W/C 24879/L (Punjab), the EC also plays an active role in organizing W/C cleaning. Amir Bashk, EC vice-chairman (and also traditionally in charge of W/C cleaning and maintenance), was asked whether the WUA handles the mobilization of labor for *khal* cleaning more effectively than before W/C improvement. Bashk replies: "Before it was a burden on my head. Now 4 to 5 persons share in organizing the work." Specifically, the EC's members keep an eye on the *khal* and decide when it is time clean the *khal*. The *pakka*-lined section is cleaned collectively by 4 farmers in a day, with this task being done at least twice a year and rotated among farmers from one cleaning to the next.

The task of cleaning and maintaining W/C Sherogay (NWFP) is organized by the WUA's chairman, Haji Khualid. Before improvement, this task required 50-60 persons working 5-6 days, twice a year. With improvement, the task still needs to be done twice a year and still requires 50-60 persons; however, the time required had been reduced to 2 days. The village follows a schedule of cleaning the W/C in March-April (after harvest) and in July-August (when there is a shortage of water and more weeds are growing in the W/C). While the farmers continue to follow the traditional system for cleaning the *khal*, Haji now assigns each committee member a specific supervisory task (e.g., supervising the weeding or silt removal, or rebuilding the banks).

Haji also reported that farmers now are more willing to work together to clean the W/C because, he says, farmers understand that they are able to get more water by keeping the W/C clean. They also recognized that cleaning is easier after improvement. Before improvement, the village elders had a hard time mobilizing labor to clean the W/C as most people were not willing to assist in cleaning the *khal*. Indeed, farmers often were fined for their refusal to assist. But, after W/C improvement, the farmers became more willing to provide the labor needed to clean the *khal*. Haji reported that he had not had to impose any fines since the W/C was improved.
Cases also were observed where the WUA was not yet playing an active role in organizing W/C cleaning and maintenance. At times this may be because of a WUA’s EC being relatively inexperienced. For example, the EC on W/C 7+665/L (NWFP) was organized only recently (in June 1987). While the EC is responsible for organizing the cleaning of the *khal*’s major and minor branches, the WUA chairman (Muhammad Riaz) indicated that the EC did not yet have any experience in organizing the farmers to do cleaning. However, Riaz reported that he had gone to the secondary branches to talk to farmers and encourage them to clean these branches. Otherwise, since W/C improvement, farmers continued to clean the main branch of the *khal* following the same procedure as prior to improvement.

In other instances, several years had passed since the W/C was improved and, during this period, the WUA became virtually inactive, with farmers reverting to or continuing to follow the traditional system for cleaning. For example, the farmers of W/C 153307 (NWFP) reported that they continue their traditional system for cleaning. When a farmer recognizes that the *khal* needs to be cleaned, he will circulate a message. This may take a week to circulate through the village. The decision about the time when the *khal* will be cleaned is not made by the WUA per se but rather by the farmers who get together in the evening in the village’s traditional meeting place (*hujra*), with the decision on the specific date being announced on the loudspeaker of the village mosque.

This latter case illustrates that irrigation management functions (e.g., W/C cleaning) may, even with time’s passage, continue to be organized by traditional institutions (e.g., village *hujra*), with the WUA never developing as an active organization within the village.

**Organizational Activities**

Management activities focusing on the organization of efforts to manage the structures that control irrigation water include resource mobilization, conflict resolution, communication, and decision making.

**Resource Mobilization.** The activity of resource mobilization entails marshalling, management, and utilization of funds, manpower, materials, information, or other inputs needed to control water through structures, or to undertake various organizational tasks. The OFWM program, as designed by the Bank, was based on the concept that benefitting farmers would finance a large portion of the improvements and all followup O&M except technical assistance. A review of the experience of various WUAs in improving their W/Cs provides evidence that WUAs, at least during the period their W/Cs are being improved, actively mobilize resources. As the following vignettes illustrate, the WUAs are active in mobilizing labor and cash for W/C improvement and maintenance. None of the WUAs collect water charges (*abiana*) as this task continues to be done by other traditional institutions.
Representatives of WUA 134,812/R (Punjab) reported that WUA members generally cooperated in supplying the labor needed to improve and maintain their W/C. Indeed, in one year, 20 farmers contributed 1,500 Rs. for repairs above and beyond their regular contribution. But some farmers were recalcitrant about paying their share of mason charges. Where they did not contribute the required labor, the WUA decided to charge them at the rate of 30 Rs. per day of labor. Also, when the actual cost of masons was less than the total money collected from members, leaving the association with some spare funds, the WUA members agreed to use the spare money to hire locally available labor for W/C maintenance. But this was the only WUA visited that was collecting membership dues. Each shareholder was paying 6 Rs. per ac every 6 months for khal cleaning and maintenance, although some had been used to repair the katcha road to the village. Some of the dues also were being used by the WUA's vice-chairman (Ghulam) to buy production inputs (e.g., fertilizer) that were being distributed to the contributing farmers.

Beyond the membership fee and labor required to demolish and improve the W/C, the WUA on W/C 27025/R (Punjab) initially collected 75 Rs. per acre from each farmer. This money, about 28,000 Rs., was used to pay masons and laborers. The bulk of the money collected was entrusted to a farmer who put it into his savings account in a bank. The money was withdrawn once a week to pay masons and laborers. As part of its agreement for W/C improvement, the WUA and OFWM Department representative had opened a joint bank account to ensure the availability of funds for W/C maintenance. But the farmers did not want to put all their money into the account, as a withdrawal would require the representative's signature. Accordingly, only 1,300 Rs. were deposited. This amount was still in the account at the time the WUA was visited. Further, the EC decided to begin to collect additional funds from WUA members after the cotton harvest.

When the WUA was organized on W/C 51170/L (Punjab), each farmer contributed 5 Rs. per acre as a share. Based on the cost estimate for W/C improvement, the WUA assessed each farmer 160 Rs. per acre to cover the cost of the masons. While only 15 farmers initially contributed, the WUA continued to collect from other farmers. When work needed to be done on the W/C, the WUA estimated the cash required for the job and the treasurer drew the cash from the bank to pay masons and laborers.

To mobilize the cash needed to improve W/C 5201/R (Punjab), the WUA took the estimated cost of the masons and laborers and divided this by the total number of warabandi hours (168) in a 7 day week. On this basis, each farmer was required to contribute 305 Rs. per hour of warabandi time. At the outset, 30 of the shareholders immediately came forward with 6,000 Rs. as a first installment, although the amount contributed by any one farmer was not necessarily the full requirement based on the farmer's total hours of warabandi time. Subsequently, the WUA continued to collect money as needed to pay masons and laborers, with each farmer's payment bringing him closer to meeting his required contribution. The farmers estimated that nearly 50,000 Rs. were raised. As more than two years had passed since this W/C had been improved, the farmers were now paying the cost recovery (25% of construction materials cost) over 5 years in 10 semi-annual installments, with each farmer paying 9 Rs. per acre each 6 months. The farmers noted that four absentee landlords had not paid any of their share. Neither the WUA's EC nor the OFWM Field Team members could propose a solution to this problem.
On W/C 24879/L (Punjab), WUA members decided that farmers would contribute 50 Rs. per hour of *warabandi* time as share capital. Some 5,000 Rs. initially was raised, with a total of 50,000 Rs. eventually collected to pay masons and laborers. This W/C was one of the few W/Cs visited where the WUA had established a schedule for the amount of labor each farmer would be required to contribute during W/C improvement. For every six hours per week of *warabandi* time, each farmer was required to provide 1 day of labor. Although the farmers were not contributing regular WUA membership dues, when the WUA needed cash, the EC called a meeting and the farmers decided how much they would need to contribute to solve the problem at hand. However, while the W/C was improved in May 1986, the farmers had not yet started to pay the cost recovery. The farmers reported that they had not mobilized any other resources for any other purpose as, in their view, the WUA was concerned only with W/C cleaning and maintenance.

The farmers on W/C 20174/L (Punjab) initially collected about 31,000 Rs. to begin improving their W/C. This money was put into a bank account for use in paying masons and laborers. Also, during construction, three farmers loaned their tractors and provided fuel. The WUA was required to pay 20% of the cost of the construction materials used in improving the W/C. The WUA successfully recovered 15,000 Rs (the full amount) paid in ten 1,500 Rs. installments, each farmer paying about 2.6 Rs. per acre per installment. While the WUA eventually mobilized 90,000 Rs, no additional resources had been raised.

During the period that the WUA of W/C 73483/L (NWFP) was improving its W/C, the EC mobilized the farmer labor required to demolish the W/C and work with the masons. Where a farmer did not or could not contribute labor, the WUA required him to contribute approximately 200 Rs. per 3 hours of *warabandi* time. Farmers estimated this to be the equivalent of contributing 7 days of labor. The money and labor were contributed on approximately a 50/50 basis, with almost 15,000 Rs. being collected in cash and some 300-400 person days in labor (tree removal, W/C demolishing, etc.). When some farmers would not contribute, the WUA resolved this by asking other farmers to bear the labor or make a cash contribution to compensate for the farmers who would not cooperate.

When W/C 22675/R (NWFP) was being improved, the WUA EC required each household to provide one day of labor for working on the improvement of the head of the W/C. If a farmer did not contribute labor, he was charged 20 Rs. for each day of labor he failed to contribute. While the WUA did not have a record of the total cash collected during W/C improvement, the money collected was spent to pay laborers who worked with the masons. Individual households provided the labor needed to install the *pakka nakkas* on individual turnouts.

The WUA on W/C Sherogay (NWFP) arranged during 1983-84 for a bulldozer to come to the village for precision land levelling (PLL) of about 60 acres of farmer fields. This required about 10 hours per acre and cost about 155 Rs. per acre. Haji, WUA chairman, had raised an estimated 100,000 Rs. to pay for the levelling and the WUA was planning to raise additional funds for more land levelling. Although PLL does not provide farmers with more water, the practice helped to spread the available water more evenly on the fields.
These examples illustrate that the role which WUAs have played in W/C improvement in terms of mobilizing cash, labor, and other (e.g., tractor) resources from WUA members. In some cases, the WUA already had completed payment of the cost recovery (e.g., Punjab, 25%), whereas in other cases the WUA was still paying the cost recovery or was scheduled to begin paying it at a future date. The role of WUAs in mobilizing farmer resources for W/C improvement represents the major contribution of WUAs to the improvement of irrigation management in Pakistan. While these vignettes present only a partial picture of the magnitude of the farmer's contribution as a percentage of the total cost of W/C improvement, Bank analyses for the OFWM-I Project estimated farmers' contributions to the irrigation investment and reinvestment costs as follows: farmers' contributions to capital costs [Rs. 286 M (PV)] and farmers' contributions to O&M costs [Rs. 137 M (PV)]. Overall, the Bank estimated that the farmers' contributions would amount to about 55% of total capital, operation, and maintenance costs, not including an estimated 13.9 M Rs. in farmers' repayment of a portion of the cost of construction materials and an estimated 23.0 M Rs. in water charge payments (Source: Internal Bank Document).

Project experience with cost recovery in the early years of the OFWM program was reported as being generally good. The first installment for cost recovery of materials was in Punjab in FY84, where the WUAs collected over US$ 50,000 or 92% of the amount due from WUA members. The recovered amount was turned over to the Provincial Finance Department. The early FY85 returns indicated a recovery in excess of 70%. Fairchild (1985:6) noted that these repayment levels were "gratifying when compared with many other repayment programs in developing countries." However, discussions with Bank officials indicated that the OFWM program has not been sustainable at a high level of cost recovery repayment. As Fairchild (1985:6) noted, "OFWM Directorate and WUA officials are well aware that the habit of repayment must be established early...and diligently enforced."

Under the WUA ordinances, non-payment of assessment by farmers can be collected "as a last resort" in the form of land arrears by the Revenue Department. While there is legal recourse to collect cost recovery in the case of non-repayment, the problem is not necessarily that WUAs are unable or unwilling to meet the repayment requirement. OFWM Field Teams continue to improve the same number of W/Cs per year. However, overall, the number of WUAs having improved W/Cs grows, thus also the number of WUAs that must begin to pay the cost recovery within 2 years of completion of improvement. Yet the number of OFWM Field Teams and the size of these teams remained constant. Thus, the OFWM Field Teams were finding it increasingly difficult to organize new WUAs and improve their W/Cs, provide followup to already improved W/Cs, and collect the cost recovery payments from WUAs. Over time, this problem will grow in magnitude as the number of WUAs required to begin payment grows.

Conflict Resolution. Activities dealing with conflict resolution focus on the differences of interest that arise in acquiring, allocating, distributing, or draining water; in designing, constructing, operating, or maintaining control structures; or in organizational activities generally. The following examples illustrate that WUAs play a limited, although effective, role in resolving conflicts over water or other matters.
Before improvement of W/C 134,812/R (Punjab), a farmer could give "101 excuses" (e.g., buffalo damage to the katcha) to account for the "accidental" diversion of water that the farmer illegally channeled to his field. With the pakka lining on a significant percentage of the khal and the installation of pakka nakkas at all turnouts, the potential and temptation for water theft have been reduced significantly. Farmers indicated that such abuses occur less frequently, that conflict over water has been reduced, and that farmers are now able to work together more harmoniously. When disputes arise (e.g., cattle grazing on another farmer’s land, or buffalo sitting in the khal blocking water flow during another farmer’s warabandi turn), the involved farmers turn to the WUA for assistance. WUA vice-chairman Ghulam reported that the WUA had told farmers to first complain to the WUA; if the WUA could not settle the dispute or farmers could not agree with the WUA’s decision, then they could take their dispute to a court. The WUA had been able to settle most cases.

On W/C 27025/R (Punjab), the farmers reported that the WUA had assisted the farmers in resolving disputes or conflicts arising over damage to crops done by animals. Farmers reported that, before W/C improvement, farmers were going to court more often over disputes. However, after improvement, the WUA was able to settle most cases. A farmer whose fields have been damaged now complains to the WUA, and the EC assists in arriving at a settlement. Farmers also noted that the WUA provides the farmers a new means to resolve disputes at the village level. Before W/C improvement, farmers had to settle disputes at the biradari (brotherhood) level (within and between biradari). "Now," one farmer said, "the WUA is like our biradari." The ability of the WUA to transcend differences between biradani stems, in part, from the EC including representation from each of the four biradari in the village, as well as representation of the head, middle, and tail reaches of the W/C.

Farmers of the WUA on W/C 51170/L (Punjab) reported that the WUA had played a role in helping to solve family disputes as well as disputes over field boundaries. Complaints (e.g., land disputes) are discussed in the WUA meetings. The WUA is able, in most cases, to assist in arriving at a settlement. Similarly, the WUA EC on W/C 20174/L (Punjab) indicated that the WUA has been effective in settling six or seven disputes that had arisen in the village. Similarly, on W/C Sherogay (NWFP), WUA farmers reported that they traditionally did not take minor cases to court but rather turned to village elders for help in resolving disputes. The WUA was continuing this tradition by helping farmers to resolve disputes and conflicts. For example, the WUA will fine a farmer whose cattle have damaged a field (e.g., grazing on crops) or the W/C (e.g., destroying the katcha banks).

At times, farmers found that their WUAs could not resolve disputes or conflicts. For example, farmers on W/C 7+665/L (NWFP) indicated they did not see their WUA as having a role in resolving disputes or conflicts in the village. In their view, the WUA was organized to improve and maintain the W/C. Similarly, when the farmers of W/C 15307 (NWFP) were asked if the WUA has played any role in helping farmers to resolve disputes or conflicts, the chairman Mohammad Roshang indicated that the association became less active after the W/C was improved. Mohammad notes that disputes or conflicts traditionally have been and continue to be settled by the village elders. Finally, W/C 73483/L (NWFP) provides an example of a WUA that had not been able to resolve a major dispute over a W/C-related problem (see Box 11). The members of this WUA indicated that they feel their WUA cannot resolve this longstanding dispute over water allocation and distribution on the W/C, and that the dispute can be resolved only by PID intervention.
While one reads about factionalism and water-related conflicts on Pakistan's W/Cs, the WUAs interviewed for this study, admittedly an extremely small sample, evidenced few if any such problems. Perhaps these problems exist and farmers were not willing to discuss them. But it is clear that the benefits brought by W/C improvement have reduced potential sources of disputes or conflict over water. Further, the experience of different groups (e.g., families and biradari) from the same W/C working together to improve the W/C provided farmers with evidence that they could work together to solve problems of common concern.

Box 11. "Our WUA Can Manage Other Things But Not This Problem"

When the WUA members on W/C 73483/L (NWFP) were asked about the role of the WUA in water allocation and distribution, they at first indicated that there had been no disputes about water rights and that there was no need for the WUA to play a role in this respect. Later the farmers revealed that there has been a long standing dispute on the W/C about the warabandi schedule. This dispute revolved, in large measure, around a question of whether certain farmers on the W/C should have a length of warabandi time that is disproportionately greater than the number of acres they actually own on the W/C. Asked whether the farmers are saying that some farmers draw water for a longer period of time than the government-sanctioned warabandi time, the farmers reply no and explain.

Prior to the construction of the lift canal, the land on this W/C had been irrigated by water diverted from the Bara River. The diverted river water irrigated this W/C as well as the land immediately above the W/C, with some of the farmers owning land above the W/C as well as on the W/C. The length of warabandi time assigned to each farmer was based on the total acres owned by farmers having lands irrigated by the diverted river water. Subsequently, the government constructed the lift canal that brought water to the present W/C, thereby providing the farmers on the W/C with a measure of increased control over the timeliness and quantity of water available to the W/C. On the other hand, farmers above the W/C remained totally dependent for their irrigation water on the water which could be diverted from the river. This source of irrigation water subsequently was eliminated when the government built the Spera Dam upstream on the Bara River, thereby stopping the flow of the river to the lands above as well as on this W/C.

With this development, any farmer having land above the W/C found himself in a position where he was no longer able to irrigate those fields lying above the W/C. But of those farmers, about 10 to 15, also owned some land, however little, on the W/C. These farmers responded to the government-created water shortage by using all their warabandi time to irrigate the fields they owned on the W/C. Given, of course, that the supply of lift canal water is finite, the strategy of these farmers effectively reduced the amount of water available to all farmers irrigating their fields with lift canal water.

Asked whether the WUA had played any role in helping to resolve this longstanding dispute, farmers replied that this problem can only be solved by the government. In other words, these farmers believe that the government should intervene to resolve the issue and this is not a problem which could be resolved by the WUA; as one farmer said: "Our WUA can manage other things but not this problem." In the farmers' view, this is a problem that the government can easily resolve.
Communication. The activity of communication entails conveying information about decisions made, resource requirements, etc. to farmers or any other persons involved in irrigation management. This includes coordination. The cases indicated that WUAs provide an effective mechanism for conveying information relevant to W/C improvement (design and construction). For example, the EC of a WUA plays an essential liaison role between the farmers on the W/C and the OFWM Department. The EC facilitates the movement of the information necessary to mobilize the cash and labor resources needed to improve the W/C. Then, after W/C improvement, the ECs of some WUAs continued to play an active role in organizing W/C cleaning and maintenance.

On the other hand, WUAs were relatively inactive insofar as water allocation and distribution or the operation the irrigation system were concerned. The former irrigation management functions (allocation and distribution) are determined and controlled by a traditional institution (the warabandi schedule), while the latter function (operation) is managed by individual farmers. The WUAs had yet to establish a constructive working relationship with the PID.

WUAs could facilitate disseminating information (e.g., advice on water and farm management) to farmers on the W/C. One WUA had collaborated with an OFWM Field Team to organize a field day at the demonstration plot established by the team. However, based on the W/Cs visited, most WUAs were playing little or no role in this respect. No cases were observed where the Extension Service had established an effective working relationship with existing WUAs; indeed, it would be more accurate to say, for those WUAs visited, that no relationship existed between the WUAs and the Extension Service.

Decision Making. The activity of decision making entails the processes, including planning, involved in making decisions about the design, construction, operation, or maintenance of structures; acquisition, allocation, distribution, or drainage of water; or the organization that deals with these activities. Whereas the WUAs visited were active in making decisions during the improvement of the W/C, the WUAs tended to become inactive after W/C improvement. Some of the WUAs visited indicated their interest in acquiring more water by establishing TWs on the W/C. But the WUAs generally had not played any role with respect to the allocation, distribution, or drainage of water.

The WUAs, particularly their ECs, were much more active in terms of providing leadership for and organizing W/C cleaning and maintenance. In a few cases (e.g., WUA 134,812/R in Punjab and WUA 73483/L in NWFP), there was clear evidence that the WUA had begun to develop into an active force for agricultural development on the W/C. For example, WUA 73483/L already has been registered as a Water Users Cooperative Society and granted a group loan by the Cooperative Bank (see Box 12).
Box 12. A WUA Becomes a Water Users’ Cooperative Society in NWFP

When WUA 73483/L was registered as the Water Users’ Multi-purpose Cooperative Society, the farmers had hoped that the Cooperative Bank would approve a loan of 500,000 Rs. The actual amount approved, however, was only 300,000 Rs. Now the farmers face a new problem—dividing the loan into smaller loans to the individual members of the Cooperative and ensuring that each farmer who receives a loan will be able to repay it. How does each farmer propose to use the loan he has requested? Which farmers can be counted on to repay the money loaned to them? These are new kinds of problems facing WUA 73483/L. How did this WUA come to find itself in this position?

This development came about as part of the efforts of the World Bank- and USAID/Pakistan-assisted Command Water Management (CWM) Project. This project works with WUAs in selected target areas and helps these associations to find ways to access the services of agri-support agencies such as credit sources and input supply firms. Khalid Mumtaz, assistant registrar at the provincial Cooperative Department, described the steps which a WUA such as 73483/L must follow to become a Cooperative Society.

The minimum number of farmers required to register a group of farmers as a Cooperative Society is ten. Application for registration can be made on a plain piece of paper, with the application signed by each proposed member’s signature (or thumb-print). Following receipt of the application, a Cooperative Department inspector visits the farmers’ village to explain the cooperative program to the farmers.

A loan granted to a Cooperative Society by the Cooperative Bank is free of interest if repaid within 12 months (for *kharif*) or 8 months (for *rabi*) of the date of the loan. After that date, a 21% interest rate for *kharif* season and 14% interest rate for *rabi* season is applied to the unpaid portion of the loan. However, if the loan is repaid in full by the Cooperative prior to that date, the Cooperative Bank will credit the Cooperative’s account with a 4.5% rebate (for *kharif*) and 2.5% (for *rabi*). Currently the Cooperative Bank reports a 90-95% recovery rate on seasonal loans to Cooperative Societies.

If the farmers are interested in registering their proposed Cooperative Society, they must form a Managing Committee which includes a president, vice-president, secretary, and treasurer. The committee must also open an account in the Cooperative Bank. The amount of the deposit required in this account is based on a minimum of 50 Rs. share capital per member farmer, with each farmer being required to deposit at least one share unit (50 Rs.) and allowed to deposit up to a maximum of 20 shares (1,000 Rs.). The total amount of money deposited, multiplied by a factor of 15, determines that Cooperative Society’s maximum credit limit. Thus, the maximum amount which a Cooperative Society can borrow each year is determined by the amount of the Society’s deposited share capital multiplied by 15.

The Cooperative Society program is designed for farmers holding small amounts of land (not more than 12.5 acres). The inspector will check that each proposed member owns land and that none owns more than 12.5 acres. When the inspector is convinced that the case is genuine, he submits his report to the Cooperative Department and prepares the registration papers and by-laws (in Urdu).
Box 12 (continued)

Also, he alerts the farmers that they need to open a bank account in the Cooperative Bank, deposit at least 25-30% of their collected share capital in the account (money deposited in this account does not earn interest), and submit a receipt to him so that he can complete the registration application file. If the treasurer does not deposit all of the collected share capital in the bank, he must provide an additional receipt confirming the amount of share capital balance which he is holding for the proposed Cooperative Society.

Once the inspector submits the Cooperative’s application, it is reviewed by the assistant and deputy registrars. Based on the farmers’ share capital, a maximum credit limit is fixed. This limit may be increased if the Cooperative Society increases the size of its shared capital. Subsequently a certification of registration is issued to the Cooperative Society. The only other fees involved in registering the Cooperative is an inspection fee at the rate of 5 Rs. per farmer.

WUA 73483/L applied for registration as "Water Users’ Multipurpose Cooperative Society" on May 27, 1987, and registration was granted on June 15, 1987. The amount of share capital raised by this Cooperative was 20,000 Rs., with 13,000 Rs. deposited in the Cooperative Bank and the balance (7,000 Rs.) held by the Managing Committee’s treasurer. Based on the total share capital of 20,000 Rs., the Cooperative’s maximum credit limit was fixed at 300,000 Rs.

To receive a loan, a Cooperative must mortgage land equivalent to the value of the maximum credit limit. In the case of the Water Users’ Multipurpose Cooperative Society, the society’s president (Samin Jan) agreed to mortgage 32 kan-nals (4 acres) of his own land which he estimates to be worth in excess of 500,000 Rs. In order to mortgage this land, Samin Jan had to go to the sub-registrar of the Revenue Department to obtain a certificate as to the quantity and value of the land that was to be mortgaged to the Cooperative Bank. This certificate was then presented by Samin Jan to the Cooperative Bank.

The Cooperative Bank has now granted the Cooperative a 300,000 Rs. loan. When the loan is issued, the Bank gives the Cooperative a check issued to the Cooperative Farm Service Center (CSFC); this check may used to purchase inputs other than seed (e.g., fertilizer) from the CSFC. As the CSFC does not sell seed, funds to meet the farmers’ seed needs are issued in cash to the Cooperative so that they can buy seed from local suppliers. The CFSC is an organization formed by the Cooperative Societies registered in the District of Peshawar.

When asked how the WUA would use the 4.5% rebate (13,500 Rs.), they replied that their first responsibility is to repay the farmers who contributed the share capital for the Cooperative. Beyond that, the farmers replied that they could hold it in reserve in case a farmer was in need of a loan. Asked why they would not use the rebate for some other purpose such as additional pakka lining or installation of a TW, the farmers’ eyes widened—they hadn’t thought this through that far ahead but immediately recognized that there may be better ways for the WUA to invest its hard-earned capital.

With the progress being made by this WUA, Samin Jan is asked if he has talked about the WUA with farmers who are members of other WUAs. He indicates that some of the member farmers of the WUA have talked with farmers on other W/Cs in the area and that the association has influenced other W/Cs to organize a WUA and to undertake W/C improvement. Asked if the farmers have ever explored the possibility of joining their WUA with other WUAs in the area to form a federation, Samin Jan replies that some farmers on this W/C own land on more than one W/C but that no steps have yet been taken to form one WUA, that is, a federation of the existing WUAs.
Summary of WUA Irrigation Management Activities

The preceding vignettes illustrate the ways in which Pakistani WUAs, once that W/Cs have been improved, are active or inactive vis-a-vis the various irrigation management activities delineated in the irrigation management matrix (Figure 1). The pattern of WUA irrigation management activity (or inactivity) that emerges from these vignettes, as perceived by this writer, is summarized in Figure 2.

<table>
<thead>
<tr>
<th>Water Users Association</th>
<th>Level of Activity</th>
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<tbody>
<tr>
<td>Irrigation Management Activities</td>
<td>None</td>
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<tr>
<td>WATER USE ACTIVITIES</td>
<td></td>
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<tr>
<td>Acquisition</td>
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<td>Allocation &amp; Distribution</td>
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<td>Drainage</td>
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<td>CONTROL STRUCTURE ACTIVITIES</td>
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<tr>
<td>Design &amp; Construction</td>
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<tr>
<td>Operation</td>
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<tr>
<td>Maintenance</td>
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<tr>
<td>ORGANIZATIONAL ACTIVITIES</td>
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<td>Resource Mobilization</td>
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<td>Conflict Resolution</td>
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<td>Communication</td>
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<td>Decision Making</td>
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<tr>
<td>DISTRIBUTION OF ACTIVITIES</td>
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</table>

Key: L (low), M (medium), H (high)
Generally, with respect to water use activities, the WUAs are relatively inactive, i.e., they engage in little or no activity with respect to the allocation, distribution, or drainage of water. Specific factors account for this inactivity. In the case of drainage, these WUAs are relatively inactive because their W/Cs suffer, as they perceive it, not from a surplus of water but rather from insufficient water. With respect to allocation, the lack of activity is primarily explained by the fact that the Pakistani irrigation system basically is supply-driven; that is, with the exception of tubewells (TWs), farmers get such water as spills from the distributaries through the mogha into farmers' W/Cs. In turn, as regards distribution, the traditional warabandi system basically determines how the available water will be allocated. Finally, with respect to acquisition, few cases were observed or reported where WUAs had obtained additional water by installing TWs on their W/Cs. Yet the desire of farmers to install TWs as a means of acquiring additional water remains a factor that potentially could be used as an incentive to motivate additional collective action on the part of farmers.

By contrast WUA activity levels were highest in the W/C improvement areas of design and construction (control structure activities) and resource mobilization (organizational activities). The desire of farmers to obtain additional water by participating in the improvement of their W/Cs provided an incentive for farmers to mobilize the required money and labor to complement the W/C improvement resources provided by the OFWM program. However, once a W/C is improved—and absent any additional incentives—the level of collective action vis-a-vis irrigation management activities generally reverts to that prevailing prior to W/C improvement. Specifically, farmers return to their traditional pattern of W/C operation and maintenance, whereby each farmer operates the irrigation system according his warabandi turn, with farmers periodically coming together to clean and maintain the W/C as traditionally was the case prior to W/C improvement.

Thus, the establishment of legally-authorized WUAs on the W/Cs generally has not resulted in farmers drastically changing or going beyond what they traditionally accomplished through their informal khal committees. Only in a few cases have WUAs begun to play more active communication and decision making roles to help their members to take on agricultural development functions (e.g., buying inputs or obtaining loans) that go beyond the limited OFWM program objective of physically improving W/Cs. But the study has shown, perhaps as a somewhat unexpected finding, that the WUAs are playing an effective role in conflict resolution on the W/Cs, thereby creating for the future a greater potential for farmers, through their WUAs, to act collectively on common problems.
THE SUSTAINABILITY ISSUE

The prognosis for the long-term survival of WUAs in Pakistan is debatable. WUAs have proven effective in mobilizing manpower and raising funds for W/C improvement. But much remains to be done if WUAs are to evolve from short-lived "paper" organizations interested in improving W/Cs to self-sustaining organizations active in promoting agricultural and rural development.

Organizational Development of Water Users Associations

For this study, the 11 WUAs visited (6 in Punjab and 5 in NWFP) were ranked according to an ordinal scale providing a relative measure of the organizational development of each association. The scale value for each WUA was assigned, based on the information obtained during interviews with the WUA's member farmers, according to the following ordinal scale:

1. WUA (or WU Cooperative Society) joined a federation of WUAs
2. Water Users Cooperative Society obtained a loan from bank
3. WUA registered as a Water Users Cooperative Society
4. WUA active (meetings and followup action) on other problems
5. WUA only active for W/C cleaning and maintenance
6. WUA mobilized resources for W/C improvement but now inactive
7. WUA registered but labor not yet mobilized for W/C improvement
8. Farmers engaged in group action to organize a WUA
9. Committee for W/C cleaning exists (e.g., khal committee)
10. Informal traditional organization for W/C cleaning exists

Based on this scale, the 11 WUAs were assigned the following values:

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<th>Punjab</th>
<th>NWFP</th>
</tr>
</thead>
<tbody>
<tr>
<td>134,812/R</td>
<td>73483/L</td>
</tr>
<tr>
<td>27025/R</td>
<td>Shergay</td>
</tr>
<tr>
<td>51170/L</td>
<td>22675/R</td>
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<tr>
<td>5201/R</td>
<td>7+665/L</td>
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<tr>
<td>24879/L</td>
<td>15307</td>
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<tr>
<td>20174/L</td>
<td>6.0</td>
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These scale values reflect great variation in the progress that Pakistan WUAs have made toward becoming "pakka" WUAs (Box 11), with many WUAs yet being relative weak or even "paper" WUAs (see Box 13). How quickly Pakistan's WUAs will progress in terms of becoming sustainable catalysts for agricultural and rural development will depend on the ability of the Pakistani OFWM program to solve a number of sociological problems. This chapter focuses on some of these problems and potential ways that these problems could be more productively addressed by the OFWM program.
Box 13. A WUA Chairman Speaks Up!

During the initial visit with the chairman of the WUA on W/C 7+665/R, Dost Mohammad, chairman of another WUA in the area, interrupted the interview to ask the purpose of this study. This is explained as Dost, perhaps in his late fifties or early sixties, listens carefully. Having heard the stated purpose of the study is to learn about the experiences of the WUAs in Pakistan, he states quite frankly. "But there is no WUA here!" He proceeds to explain how the "contractor" (the representative of the OFWM field staff) came to the village and organized the WUA as a mere formality so that the work to improve the W/C could proceed. Dost states that the WUA was never organized in a proper way, that the farmers never received any explanation or training as regards the purpose or activities of the WUA.

Much discussion ensues between Dost and a representative of the OFWM Department. Dost agrees with the representative's view that the WUA was effective in mobilizing the labor needed for W/C improvement but he persists in asking where is the WUA of which he is supposedly the chairman. He states that such an association should have authority. For example, he indicates that the farmers have been discussing the possibility of imposing a fine (e.g., Rs. 1,000) on any farmer caught stealing or wasting water. But he states that he doesn’t know how the farmers could enforce such a sanction.

Dost, who is fluent in English, is asked if he has ever seen the NWFP WUA Ordinance. He claims that he has but it is determined that he actually is referring to the Irrigation Act. A copy of the WUA Ordinance for NWFP is handed to Dost and he and the other chairmen present are asked if they have ever seen this Ordinance. They reply that they have never seen the Ordinance and, in fact, did not know of its existence. Asked if any of their WUAs had ever received a group loan, the farmers indicate that they haven’t. Nor are they aware of recent developments in other parts of Peshawar district where four WUAs (under the Command Water Management Project) are being registered as Cooperative Societies, which will make them eligible to receive group loans.

For Dost, the WUA, if it existed at all, was nothing more than a formality, a means by which the "contractor" mobilized labor needed for W/C improvement. Now that he and the other WUA chairmen held the NWFP Ordinance in their hands, one could see that they were eager to read its provisions and learn how the farmers could begin to make their WUA a means for achieving objectives which they themselves, rather than the "contractor" or the government, have defined. On a subsequent visit, it is learned that this "WUA" never was registered as such prior to the W/C being improved. Indeed, it is learned from an OFWM Department representative that a total of 59 WUAs were registered recently by the department, each being registered after its respective W/C had been improved.

Sociological Problems in WUA Component of OFWM Program

It is sometimes reported that WUA performance of O&M on improved W/Cs falls short of anticipated levels. One might conclude that this is only logical once the enthusiasm for a major rehabilitation effort with its "strong incentive of extra assistance and resources" has dissipated. But this argument implies that farmers only are motivated by a "strong incentive of extra assistance and resources." But the problem actually is more complex.
The WUA Ordinance

Promulgating a WUA ordinance in each of Pakistan's four provinces was a major breakthrough. But the Punjab ordinance does not set forth the purpose, functions, or powers of a WUA beyond the WUA's role in W/C improvement and maintenance. Nor is there provision for federating WUAs at the distributary and canal levels. Further, the Punjab ordinance states that: "The decision of the [OFWM] Field Officer granting or refusing to grant registration [of a WUA] under the Ordinance shall be final and shall not be called in question in any court or before any authority." Unlike the corresponding provision in the other three provinces' ordinances, Punjab farmers are given no right of appeal. The Punjab ordinance makes no provision for WUAs to have authority and responsibility for improving the drainage of water from the W/C and the land irrigated by the W/C.

In short, the Punjab ordinance, in failing to spell out the potential utility of a WUA to the farmers beyond W/C improvement and maintenance, is weak in terms of empowering Punjabi small farmers. The ordinance provides a poor vehicle for informing farmers on how they may use their WUAs to achieve objectives that they, rather than the GOP or OFWM program, define. Indeed, the ordinance seems to have been designed solely to meet the Bank's requirements that the farmers on a W/C first organize into a registered WUA before the OFWM Field Team commences work on W/C improvement, and that the WUA and its member farmers be legally responsible for the W/C's maintenance after improvement.

While the Sind ordinance includes a provision for the federation of WUAs along minor and major canals, the ordinance does not include a provision for a landlord's tenants (haris) to be members of the WUA in which the landlord is the member (and also most likely the chairman). As OFWM-I made promulgation of the Sind WUA Ordinance a condition for credit financing, the delay in getting this ordinance promulgated led the Bank to suspend the OFWM program in Sind during FY82. When the ordinance eventually was passed, it excluded tenant farmers from forming their own WUA or being members of the WUA on their W/C, thereby precluding tenants from the option of meeting credit needs through group credit that a WUA can obtain from the Cooperative Bank if it is registered as a Cooperative Society. Thus, tenants will continue to be dependent on their landlords to meet their credit needs. This definition effectively excluded tenants from being members of the WUA on their W/C.²

²Other areas in which the provincial WUA ordinances needed correction are: (a) Amend the NWFP and Baluchistan ordinances such that the "Canal Officer" reference is deleted and replaced by "Director, OFWM"; (b) Amend the Sind ordinance's sub-clause (3) of clause 1 to cover the "entire Province" (as is the case for the other three provinces) rather than "project area," and clause 15 to the effect that the Agriculture Department replaces the Irrigation Department in respect of settling disputes; and (c) include in all ordinances a clause ensuring the sustainability of W/C maintenance, in the event that registration of a W/C's WUA is cancelled subsequent to W/C renovation. In respect of item c, the Punjab ordinance's sub-clause 2 of clause 10 covers actions to be taken to preserve WUA money and equipment but does not address the main asset, the W/C itself.
The provincial WUA ordinances had received only limited distribution in a language other than English. Some of the ordinances had been translated into Urdu (e.g., the Punjab Ordinance). Field visits confirmed the existence of cases where WUA chairmen fluent in English had never seen their provincial WUA ordinance or did not even know that such an ordinance exists. This represents a major deficiency in the implementation of the OFWM program, namely, effective means have yet to be set in motion to ensure that a WUA ordinance’s intended beneficiaries—WUA chairman, EC members, and member farmers—know and understand their legal rights and obligations under the ordinance. Such action will entail preparation and distribution of appropriate printed material, coverage of the relevant subject matter during training activities, and followup discussions of these materials by WUA leaders in their meetings with member farmers.

Strategy for Organizing and Registering WUAs

The OFWM program’s WUA concept provides a case study in the difficulty involved in taking a concept successful elsewhere and introducing it into an environment in which it may or may not take root, depending on how well adapted the concept is to its new environment. But the WUA concept in the Draft WUA Ordinance does not take into account the role that existing traditional forms of farmer organization along a W/C (e.g., "khal committee" in Punjab) play in decisionmaking. Nor does the ordinance take into account the potential constraining influence that a tenant’s relationship with his landlord may have on the tenant’s willingness and/or ability to participate in the WUA of a particular W/C. Other social problems (e.g., tribal patterns in Baluchistan and NWFP, family feuds in NWFP, etc.) similarly are neglected.

The WUA concept also does not indicate how this institution and organizational form and the WUA’s member farmers are expected to perform in an environment where farmers along the W/C are at the mercy of civil servants such as the patwari of the Revenue Department or the Irrigation Department. An effectively functioning WUA could strengthen the hand of farmers on the W/C and help them to redefine their relationships with those who currently exploit the farmer’s desire to increase the amount of water received by his fields and to reduce the water tax which he must pay on the irrigated land he crops.

Quite aside from how ready and willing farmers are to support and participate in their WUA, OFWM Field Team members, primarily trained in engineering or agriculture, are under pressure to meet physical targets (i.e., a certain percentage or so many meters of pakka lining, so many pakka nakkas installed, so many culverts constructed, etc.). With the yearly physical targets being set by the OFWM Directorates and/or various Bank-assisted projects, the teams have little time, and less interest, to be concerned about whether they are using the most effective means to organize sustainable WUAs. The evidence suggests that the teams often register a WUA merely as a formality to meet the requirement that a WUA exist on the W/C before its W/C is improved. This pattern was noted in WAPDA’s M&E studies in the OFWM Pilot and OFWM-I Projects as well as in the present study’s field visits with WUAs in Punjab, Sind, and NWFP.
As the OFWM program currently is structured, an OFWM Field Team’s main concern is to improve the W/C. Organizing and registering WUAs is only a means to achieve this end. Moreover, as the teams have gained experience in W/C improvement, they are now able to improve a W/C much more quickly than at the program’s outset. Thus, they are able to move on to the next W/C more quickly. While WUAs definitely exist and are active during W/C improvement, they are likely, once W/C improvement is completed, to become inactive, in effect, "paper" organizations.

While cases were identified of W/Cs where the farmers were involved in lengthy discussion before agreeing to organize themselves into a WUA, there also were cases where organizing and registering a WUA and improving the association’s W/C proceeded so quickly that the farmers’ thumb print signatures inked on proforma applications for registering the WUA and for improving the W/C hardly had a chance to dry before improvement of the W/C commenced. There is a strong possibility in these cases that farmers were left wondering what this "Water Users Association" is all about. Indeed, as WAPDA (1985b:V-20) found in its OFWM-I M&E study: "Mostly respondents acknowledge one short visit of [the] Agricultural Officer or Water Management Officer in the beginning explaining briefly the purpose of forming an association and what is required from the farmers." This led WAPDA (1985b:V-20) to conclude that "such brief meetings could only make [the] impression that a casual organization is needed to complete the formality and to [provide] supervision and local management during improvement."

This picture was etched more clearly during field visits with WUA chairmen who reported being told that they needed to organize a WUA so that the OFWM Field Team could assist farmers with improvement of the W/C. As a result, as one WUA chairman in NWFP said, "There is no WUA here. Where is the WUA? If you are going to organize farmers, it should be done in the proper way." Farmers, he said, were never told the intended purpose of the WUA beyond W/C improvement. Yet these teams, comprised of personnel schooled in engineering and agriculture, lack personnel with the necessary training, skills, and experience in fields (e.g., leadership development, organization, institution building, and economics) that could be useful in designing program interventions that would be more effective in helping WUAs become organizations capable of functioning as sustainable development catalysts.

In the rush to organize and register WUAs, and lacking any assistance beyond that provided by the OFWM Field Team, farmers are not required to take time to meet, discuss, and make plans about what their WUA will do after W/C improvement. As the situation currently stands, once the W/C is improved, member interest in the WUA begins to dissipate, like water leaking from an unimproved katcha, for these are all too often "katcha WUAs" and not "pakka WUAs". While Bank and USAID officials lament that the WUA members are not active in maintaining their W/Cs after improvement, the chairmen of these "katcha WUAs" all too frequently champion no other cause than advancing these associations’ petitions for additional pakka lining on their W/Cs.
In the OFWM program, the design and approach to implementation failed to include an effective strategy, and the necessary resources to implement that strategy, for WUAs to function as the farmers’ own vehicle for investing in and sharing the benefits of development. Rather, the WUAs all too often have functioned solely as the OFWM Field Team’s vehicle for mobilizing farmer labor and cost recovery for W/C improvement.

In terms of development strategy, the farmers on a W/C are never given sufficient time prior to W/C improvement, nor is it ever programmed that the WUA have sufficient time once organized and registered, to work out among themselves, assisted by outsiders where this would be helpful, the farmers’ ranking of problems, the farmers’ strategy for how their WUA can most effectively deal with these problems, and the farmers’ agenda of activities that the WUA would implement in conjunction with—prior to, during, and after—improvement of their W/C. Thus, many of the WUAs organized for W/C improvement, upon completion of W/C improvement, have been left to wander aimlessly without means to navigate or propel themselves.

How can the OFWM program improve the process of working with WUAs? What is needed is a broader concept that emphasizes:

- Establishment of firm criteria to be followed in selecting the specific W/Cs on which the OFWM program will work;
- Commitment to:
  -- Building viable WUAs as the program’s primary objective, not simply as a formality to be met in order to proceed with W/C improvement, and
  -- Using W/C improvement as one of the means to build viable WUAs (rather than organizing WUAs as a means to improve W/Cs);
- Accelerated implementation of ways and means to raise the level of farmer awareness, knowledge, and understanding of the purpose, functions, and powers of a WUA as set forth in the provincial WUA ordinances;
- Provision of technical assistance and training to help WUAs to:
  -- Identify and rank problems according to priority;
  -- Formulate strategies to deal with selected problems;
  -- Design an agenda (program) of activities to work on selected problems; and
  -- Leverage the collaboration of agri-support institutions (e.g., credit providers, input suppliers) essential to implementing the WUA’s program agenda.

Many of these elements were being incorporated in a more systematic way into the USAID-assisted technical assistance component of the Command Water Management Project. But the need is clear for these same elements to be incorporated as soon as possible into all OFWM initiatives involving a WUA component.
Member Awareness of WUA Obligations, Rights, and Powers

Although there are exceptions, WUA members generally have little, if any, understanding of the purpose or functions of a WUA beyond the idea that the WUA was something they were required to organize and register with the OFWM Directorate as a condition for help in W/C improvement. WUA members have limited awareness and knowledge of their obligations, rights, and/or powers under their provincial WUA ordinance.

The lack of farmer awareness of the purpose or functions of the WUA, as WAPDA (1985b:V-1) concluded, "probably...happened because farmers misconceived the objectives, perhaps for lack of proper training and guidance, and thought that WUAs were only needed during the improvement phase." Given that the various Bank-assisted irrigation projects have provided thousands of WUAs with a 75% subsidy on the cost of the construction materials used in W/C improvement, it is easy to conclude that a lot of money has been spent teaching farmers the wrong lesson.

While some of the provincial WUA ordinances (e.g., Punjab) have been translated into Urdu, neither English nor Urdu versions of the provincial WUA Ordinances have been widely distributed. The FWMC and provincial Water Management Training Institutes had begun to take steps to remedy this situation through the preparation and dissemination of extension materials about improved water management and the role of WUAs in this effort. Also training programs were being developed at the training institutes for OFWM personnel and in the field for WUA chairman and members. These efforts to inform WUA members about their obligations, rights, and/or powers under their provincial WUA Ordinances should be intensified.

Managerial Capability of Local Leadership

From one W/C to the next, one encounters WUA chairmen who are not aware of or have not seen or read their province's WUA ordinance. OFWM program success in improving W/Cs is an indicator of the potential managerial capability of local leadership on the W/C. But improving W/Cs is almost non-controversial. OFWM Field Team personnel (engineers or agriculturists) find that technical assistance to improve W/Cs is a much safer role than organizing WUAs to place demands on the OFWM Department or other agencies; and, for every W/C improved, there are ten W/Cs yet needing to be improved, hence the pressure for the OFWM Field Teams to move on to the next W/C. But this approach fails to address the need before, during, and after W/C improvement for the OFWM Field Teams to assist in developing the managerial capability of the WUA’s EC. If a WUA is to continue to be active after the W/C has been improved, the EC’s leadership is essential. To date, OFWM Field Teams have had neither the trained personnel nor the resources to provide the kind of technical assistance that would enable WUA ECs to play an active role in developing post-W/C improvement activities. Until the OFWM Field Teams provide WUAs information about more productive ways to use scarce resources, local WUA leadership will continue to press for more subsidies for pakka lining.
Official Attitude toward WUAs

There are two areas in which the attitudes of the GOP as well as the provincial governments will contribute to or impede development of WUAs. The first is that of whether officials view the OFWM program as a means to improve W/Cs or to facilitate the development of WUAs. If an OFWM Field Team only organizes a WUA as an expedient to improving a W/C, thereafter losing all contact with the WUA, then the WUA is likely to wither regardless of how active it may have been during W/C improvement. But if the teams provide followup services to the WUAs that have improved their W/Cs, this will stimulate continued development of these WUAs.

The second is whether officials perceive the development and strengthening of WUAs as a divisive force that would enable the associations to make inappropriate and political demands on the federal and provincial governments. Where this perception is present, one may question whether the agencies having responsibility for implementing assistance to WUAs would be willing to organize and empower WUAs to federate and challenge the authority of the Provincial Irrigation Department and other agencies. In a similar vein, one could envision that administratively relocating the OFWM program from the provincial-level OFWM Directorates to other agencies (e.g., WAPDA or the provincial-level Extension Service) could greatly weaken the program’s chances for developing WUA capability to carry out irrigation management and agricultural development functions.

On the other hand, officials may view WUAs in a more positive light, perceiving that farmer involvement in decisionmaking will lead to greater equity and efficiency in irrigated agriculture. This latter view is reflected in the Bank-assisted Command Water Management Project (Cr. 1487-PAK) that envisions further development of the role of WUAs to include:

- Membership of a WUA on Subproject Coordination Committees to afford farmers a voice in the decision-making process;
- Registration of a WUA as a Cooperative Society, thereby making the WUA eligible to receive group loans from the Cooperative Bank;
- Organization of WUA Federations along minors and distributaries; and
- Involvement of WUAs in providing non-water inputs to members.

Coordination of OFWM with Adaptive Research and Extension

The OFWM program has tried various means to provide technical support to farmers after W/C improvement. Often a Water Management Officer/Agriculture (WMO/A) is assigned to work with a WUA’s members after a W/C has been improved. In addition to encouraging farmers to continue to maintain their W/C after improvement, he also is responsible for establishing 1-acre demonstration plots on selected improved W/Cs. In other cases, the OFWM Directorate has arranged with the Provincial Agriculture Directorate’s Adaptive Research and Extension Department to provide extension workers, Agriculture Officers (AOs), and Field Assistants (FAs) with training in water management.
But neither approach has proven effective for such reasons as lack of coordination, personality clashes, interdepartmental jealousy, insufficient budgeting of resources needed to support field programs, and inadequate project design. Specifically, the problem is one of finding effective ways and means to integrate adaptive research and extension into the OFWM program. Farming systems research and extension (FSR/E) models being adapted in many developing countries provide a potential solution, namely, to build a systematic adaptive research and extension capacity based on the farmer’s traditional practice of informal experimentation (trial and error). This could be accomplished by providing the Provincial Agriculture Department a mandate and sufficient resources to field adaptive research and extension teams to work collaboratively with the OFWM Field Teams and selected WUAs in planning and implementing an on-W/C adaptive research and extension program tailored to the agricultural problems of greatest concern to a WUA’s members.

As a condition for participation in the program, WUA members would designate a field on the W/C as the WUA adaptive research/demonstration plot. The EC would work out with the plot’s owner compensation for the WUA’s use of the land (e.g., payment of rent based on the net proceeds from the sale of crops grown on the plot, or each farmer could be assessed a portion of the rent). The farmers also would agree on how the plot is to be irrigated (i.e., within the warabandi turn) after W/C improvement. Finally, the farmers would agree to work with the OFWM WMO/A and Agriculture Department’s Adaptive Research/Extension team in planning, implementing, evaluating, and disseminating the results of adaptive research initiatives carried out on the plot.

One may hypothesize that the farmers on a W/C will be more likely to agree to these requirements if meeting them is imposed by the OFWM Field Team as a condition for assistance for improving a W/C. In other words, as one increases the ante on how much government support farmers perceive they will be able to leverage or command by virtue of organizing into a WUA, and by improving and continuing to clean and maintain their W/Cs, the greater the incentive the farmers have to work together before, during, and after W/C improvement. The opportunity to participate in and receive the benefits of an adaptive research/extension program conducted by the farmers on their own W/C becomes a major inducement for farmers to support and participate in their WUA.

Training of WUA Chairmen, Officers, and Members

Varying emphasis has been placed from one OFWM project to the next on the role of training in W/C maintenance, improved water management, and development of their WUA. This range of topics, however, is potentially too narrow and seems dictated by the biases of those attempting to use the WUAs as a vehicle for W/C improvement and post-improvement maintenance, rather than by information needs as defined by farmers. Further, although there are exceptions, the concept of training that prevails does not go beyond traditional, and all too frequently ineffective, classroom-type approaches where farmers are brought together at some site to receive the information set forth in a pre-defined lesson plan, with supporting overhead visuals and take-home "memory cards."
While this approach bores adult learners and is ineffective from a behavioral change standpoint, it also fails to generate a learning incentive—a "need to know." Adults learn best when they have a "need to know." The challenge for trainers is to create such an environment. Only then can the trainer reach the "teachable moment" when the learner is most receptive to making the effort to acquire new knowledge useful in solving the problem that he or she faces. There are two approaches that could be employed by the OFWM program to create "teachable moments" and enhance mastery of W/C management.

Training via On-W/C Research and Extension. The first approach is to make training an integral part of an adaptive research and extension program, such that farmers can relate water management to farm management decision making problems. When WUA members are involved directly in designing, implementing, and evaluating an adaptive research plot on a WUA-managed field (e.g., field trials comparing an improved practice with a farmer practice), there will be many "teachable moments" when farmers find their own knowledge lacking and that they have a "need to know." Only then can a learner effectively relate new knowledge to his personal situation. Also, this process enhances the opportunity for research, extension, and OFWM personnel to acquire useful, site-specific knowledge possessed only by the farmers of that W/C.

Training via Simulation. The second approach to water management training is that of a gaming or training simulation such as the "Green Revolution Game" based on field experience in India. The simulation envisioned here, which could be readily developed using available secondary data, might be called "The Warabandi Game" (see Box 14) or "W/C Development." In the simulation, the learners (water users) are assigned roles (e.g., being an Irrigation Department patwari, one of many small farmers at the middle or tail reaches of the W/C, or a large landlord at the head or tail of the W/C). Farmer participation in such a simulation not only would generate interest in and enthusiasm for improved water management but also create in the farmers the "need to know" about how to manage water more effectively, how to organize a WUA, and how to make the WUA work in the interests of the water users.

Potential of WUAs as Multifunction Organizations

Available evidence indicates that the activity level of WUAs tends to fall off upon completion of W/C improvement, and that donors are concerned that the WUAs have not been effective in motivating continued W/C cleaning and maintenance after improvement. Yet the data also indicate that the technology involved in improving the W/Cs has the effect of reducing the level and frequency of maintenance and cleaning that farmers perceive as being needed. In effect, the W/C improvement technology successfully introduced by the OFWM program may carry with it the unintended consequence of reducing the incentive for farmers to take group action, be it through a traditional "khal committee" or a modern "Water Users Association," to clean and maintain their improved W/Cs.
Box 14. "The Warabandi Game": A Proposed Training Simulation

In this simulation, each water user is assigned a specific warabandi turn and attempts to achieve certain objectives (e.g., the water user tries to increase the amount of water received and land planted, while trying to reduce the water tax assessed by the patwari). Throughout the simulation, players are confronted by problems they must solve through decisionmaking, allocating assigned but scarce resources, and communicating with other players on the W/C. These problems could be of varying types but would, given the OFWM program's interest in W/C improvement and WUAs, logically include opportunity for players to organize a WUA and improve their W/Cs, or to engage in other activities (e.g., registering the WUA as a Cooperative Society, obtaining a group loan from the Cooperative Bank, etc.). Alternate decisions paths and learning outcomes could be built into the game, with the objective of raising the learner's awareness and knowledge of the potential and problems involved in technological (e.g., W/C improvement) and institutional (e.g., WUAs) change.

In the process of making decisions about how best to deal with the problems encountered, the players would be presented with opportunities to acquire technical information about various topics (e.g., participating in an on-W/C adaptive research and extension program on water management techniques, attending a slide show on improved water management practices, or reading a pamphlet about how to organize a Water Users' Cooperative Society). As there are always transaction costs associated with acquiring information, that is, information is not free, players choosing to acquire information (knowledge) would have their allocated stock of resources (e.g., 365 person days in a year) reduced by a specified amount (e.g., two person days for contributing labor to the on-W/C adaptive research plot).

While the problem of conveyance losses in a W/C and the desire of farmers to increase the quantity of water available to irrigate their fields act as strong incentives for farmers to form a WUA to improve their W/C, the W/C improvement technology effectively reduces the need or incentive farmers originally had to work together to clean and maintain their W/Cs. Further, the ease with which the W/C now is cleaned has led some WUTAs to establish systems whereby farmers individually clean assigned sections of the W/C at a time convenient to each farmer rather than requiring all farmers to clean the W/C collectively at the same time.

Thus, WUAs will be active and viable in the long run only if their members perceive that their WUA provides a means to achieve other desired objectives, beyond W/C improvement and maintenance, that farmers cannot individually achieve. The opportunity for WUA members to participate in an on-W/C adaptive research and demonstration program can provide farmers with an attractive incentive to motivate them to continue supporting and participating in their WUA. Of course, the opportunity to participate in on-W/C adaptive research and extension may not be the most attractive inducement for some WUAs. But assistance need not be limited only to establishing adaptive research and demonstration activities. A WUA's members will likely be quick to identify other problems on which they would like their association to work, such as:
• Registering the WUA as a Water Users’ Cooperative Society, thereby opening the door for the WUA to obtain group loans from the Cooperative Bank;
• Installing and operating a WUA-owned TW on the W/C;
• Initiating a farm or social forestry project on the W/C, with individually owned or WUA-owned fields planted to tree species that will meet household consumption requirements for fuelwood, fodder, timber, and cash; or
• Developing a community livestock or aquaculture project as a potential source of revenue for the WUA.

Some have argued that multifunction WUAs would be stronger than single purpose WUAs. But the requirements for successful management of a multifunction organization place much greater demands on the organization’s members than is the case with a single function organization. As the situation currently stands, existing WUAs have not even had adequate orientation and training to ensure their ability to function as effective single purpose organizations. To attempt to convert such organizations into multipurpose organizations, expecting that they will be able to run before than can even walk, almost guarantees that the "new" WUAs will soon collapse under the weight of their new responsibilities. The WUAs need opportunity to act on options that, if successfully implemented, will enable them to move toward becoming viable multipurpose organizations. Box 15 presents a possible sequence of options that, if successfully and successively adopted by a WUA, could progressively strengthen the association’s ability to develop as a multipurpose organization. However, the particular sequence of activities around which water users would have greatest incentive to support their WUA could vary from one WUA to the next, and would need to be determined for each case.

**Box 15. Hypothetical Sequence for WUA Development in Pakistan**

- WUA is formed to improve and maintain W/C and improve operation of the water management system (e.g., an improved warabandi schedule to provide more timely delivery of water to meet crop requirements for moisture);
- WUA participates in an ongoing on-W/C adaptive research and extension program;
- WUA reorganizes into a Water Users’ Cooperative Society, with eligibility for the Society to receive a group loan;
- WUA invests own/borrowed capital in revenue-generating or possibly "no profit/no loss" ventures (e.g., installing and operating a W/C tubewell or a holding reservoir);
- WUAs along a distributary and/or canal join in a federation to undertake group action to clean and maintain distributaries;
- WUAs in a region join into a Regional Water Users’ Cooperative Marketing Society to pool farmer produce and capture scale benefits in marketing selected agricultural commodities; and
- Regional Water Users’ Cooperative Marketing Society begins wholesaling agricultural inputs (e.g., fertilizers) to member Water Users’ Cooperative Societies who, in turn, retail the inputs to member farmers.
It would not be wise to structure assistance to force a preconceived sequence of options on WUAs. Assistance should be structured so that participating agencies have the flexibility to assist WUAs in implementing the most appropriate sequence of options given each WUA’s circumstances. One approach to achieving flexibility would be to establish a “special projects” program that would receive proposals submitted by WUAs and make grants, on a merit basis, to those WUAs proposing technically sound, economically viable, socially feasible, but most of all, innovative adaptive research or revenue-generating projects.

Grant money to support such projects needs to be closely monitored and evaluated by an appropriate agency to ensure that other WUAs will be able to share in the experience of the special project and that other WUAs attempting similar projects in the future will be able to avoid past mistakes and gain by the positive lessons generated during the special project. The "special project" mechanism described above could provide a means of structuring assistance to WUAs so that it has maximum flexibility to assist WUAs to respond to the problems they identify as having the greatest priority and to the market opportunities they identify as being most attractive in terms of potential returns and associated risks.

WUAs as Revenue Collecting Agents

Previous studies (e.g., Lowdermilk, 1986) have noted that farmers are caught in a squeeze between (a) making illegal payments to PID employees (patwari) to obtain increased quantities of water and (b) making illegal payments to Revenue Department employees (patwari) to reduce water taxes. Thus:

- Farmers are driven to break the law by avoiding water taxes, making illegal payments to the patwari, tampering with the W/C’s mogha so they can obtain more than the sanctioned discharge, and making illegal payments to the PID patwari to look the other way, etc.; in the end, the farmer loses respect for the state.

- The state does not receive its full due in terms of the water tax owed based on the acres and types of crops the farmer grows with the irrigation water available to him.

- The state’s own employees (patwari) become corrupt in the performance of their appointed duties; further, the illegal payments they receive contribute directly or indirectly to reducing the water taxes received by the state.

- The state’s own employees (the PID patwari) contribute to reduced irrigation efficiency to the extent that tampering with a mogha results in reduced water velocity within the distributaries and, thereby, increased canal silting.

- The water taxes that farmers pay go directly into the state’s general revenue account; the total water tax paid by farmers has nothing to do with the size of the PID’s budget or how it is deployed to operate, maintain, or improve the canal and distributary systems on which farmers depend for irrigation water. Thus, there is no incentive for the irrigation system’s supply component (PID engineers) to be responsive to the problems and needs of the system’s demand component (farmers cum water users).
Water users through their WUAs already have the responsibility to recover their member’s share (10% in NWFP, 25% in Punjab and Sind) of W/C improvement costs. One solution to the problem described above would be to expand the authority of WUAs to include responsibility to collect the water tax owed by each WUA member (see Box 16).

**Box 16. WUAs as Revenue Collecting Agents: A Scenario for Discussion**

Expansion of the authority of WUAs to include responsibility to collect water taxes could be achieved by amending the provincial WUA ordinances to include provisions for:

- Each WUA to be responsible for monitoring and approving the *patwari*’s record of the amount of water tax each farmer owes, and collecting the water tax from each farmer.
- Each WUA to retain a percentage (e.g., 10%) of the tax collected, depositing the percentage in the WUA bank account.
- Each WUA to pay the tax collected less allowed percentage directly to the PID, with the amount paid to the PID being reported to the distributary and/or canal federation of which the WUA is a member.
- Each WUA through its distributary or canal federation of WUAs to elect a Board of Directors for a Provincial WUA Federation.
- The Board of Directors of the Provincial Federation of Water Users’ Associations to have oversight responsibility for the design, review, and approval of the PID’s 5-year and annual operating plans as well as authority to make line item vetoes in the PID’s budget.

One may envision the potential to create, in each province, a semi-autonomous irrigation and agricultural development authority which might be called the Provincial Irrigation and Agricultural Development Authority (PIADA). Such an authority would: (1) assume the technical functions of the current Provincial Irrigation and Agriculture Departments; (2) operate under the authority and management of the Board of Directors of the Provincial Federation of Water Users Associations; and (3) provide maximum accountability of the system’s irrigation and agricultural technology supply components to the system’s demand component (needs of farmers *cum* water users).

**Federation of WUAs**

W/C improvement has directly benefitted farmers in the initial phase of OFWM-I and II and other projects involving OFWM. Yet farmers may not be convinced that maintaining a W/C per OFWM standards will be of any greater benefit, especially if there are problems in the delivery system above the W/C. WUAs having authority limited to the W/C will not be perceived by farmers as having much impact on irrigation performance. But if WUAs along a canal federate into larger bodies, they can have greater influence on the main system’s operation. While this possibility is suggested in the WUA ordinances, no cases were identified (nor could OFWM personnel identify) where a WUA had joined other WUAs in a federation. This was being explored in the CWM project but should be actively pursued in the OFWM program.
Private Sector Support for Development of WUAs

W/C improvement and increased water availability will continue to influence the total area cropped, the cropping intensity, the cropping pattern, and input use levels. Intensified production at the W/C level will shift the demand for certified seeds, fertilizers, pesticides, and herbicides. WUAs could assume a greater role in helping to meet member needs for inputs, but it is not clear whether they could perform this function or provide ancillary support services as efficiently as a competitive, private sector input industry.

Do the many large fertilizer companies in Pakistan, including NFC, Fauji, and ESSO, have a role to play in developing WUAs? Are WUAs not a large market for these companies? What are they doing to tap and further develop this market, to build mutually beneficial links between the farmer as the buyer of inputs and the retailer as the seller of inputs? What technical support services do these companies provide to expand their market? More generally, what role could Pakistan’s private sector play in facilitating the development of WUAs? (see Box 17).

Box 17. Pakistani WUAs and the Private Sector

Fertilizer companies in India are competitive, as the market is comprised of state-owned, privately-owned, and cooperatively-owned fertilizer companies. Precisely because of this diverse fertilizer market, Indian fertilizer companies have an incentive to compete. These companies have aggressive marketing programs to promote fertilizer sales and provide ancillary technical services. Among the most innovative of these marketing initiatives is the "Adopted Village" program, whereby an individual company (e.g., Indian Farmers’ Fertilizer Cooperative) "adopts" a number of villages to receive an integrated program of agri-support services including demonstration plots, credit, retail availability of inputs including fertilizer (not surprisingly of the company adopting the village), and other components (sometimes including farmer training or social benefits in nutrition or health). The program’s cost is built into the price of the fertilizer and recovered bit by bit over hundreds of thousands of bags of fertilizer sold. The program does not necessarily cost the fertilizer company or the farmer any extra as long as the ancillary support services assist farmers in learning how to use fertilizer efficiently rather than wasting it.

Is there potential for a similar program in Pakistan? Where is the ESSO "WUA Development" campaign, the NFC "Adopted Watercourse" project, or the Fauji "Farmer’s Friend" program? Further, how could private sector banks support such a program? Commercial banks may be reluctant to make loans to small farmers? But such banks could indirectly help the small farmer by providing investment loans to fertilizer companies seeking to expand their markets or dealer credit to the small, private fertilizer retailer, if fertilizer wholesalers do not already provide dealer credit.

Also, is there potential for large marketing agents and food processing firms in cities such as Karachi and Lahore to contract with WUAs for agricultural produce meeting market specifications (i.e., timing of delivery, grades and standards, and volume)? What can be done to stimulate Lahore or Karachi food processing firms to establish contractual arrangements with WUAs in the surrounding countryside? How can WUAs in NWFP grow vegetables or fruits and link most effectively with domestic/export markets?
GLOSSARY

AGRICULTURE

cropping intensity crop acreage in any season divided by the CCA x 100, where CCA is cultivable commanded area

deh land area under revenue control of patwari

kharif wet season (mid-April to mid-October)

rabi dry season (mid-October to mid-April)

kan-nals unit of land (NWFP); 8 kan-nals = 1 acre

SOCIAL STRUCTURE

abdar Irrigation Department officer in charge of watercourse; checks on the guages (of mogha) and oversees water sharing on those watercourses for which he is responsible; also referred to as the patwari (ditch rider)

ashar traditional system of informal labor exchange (NWFP)

biradari brotherhood kinship unit

canal assistant supervisor of the abdar; responsible for enforcing regulations with regard to canals and watercourses

chowkidar the individual who assists the numbardar

district for revenue purposes, controlled by a Deputy Commissioner (formerly Collector)

hari tenants (Sind)

hujra place where villagers meet in the evening (NWFP)

kalimashar head of zamindarano tanzeem (NWF)

kalomashar head of all the zamindarano tanzeem of the villages on a civil canal (NWFP)

lana or seri an informal partnership in which two or more farmers cooperate in a task (e.g., joint cultivation of leased parcel of land, trading irrigation turns, etc.)

numbardar the recognized official leader of the village; traditionally collected seasonal canal and land taxes

patti group of brotherhoods

patwari ditch rider or Revenue Department employee who makes assessments for water charges; is under the supervision of the zillidar of the Revenue Department; another term for abdar

sub-division under the district for revenue purposes, controlled by the Assistant Commissioner

taluka revenue area beneath the sub-division; consists of several tapas

tehsil same as taluka in Punjabi

wangar or mangi trading of animals and work labor for land preparation, leveling fields, planting rice seedlings, threshing of grain, and other collective tasks

zamindarano tanzeem watercourse cleaning committee (NWFP)
WATER MANAGEMENT

abiana | water charges
branch canal | take-off from main or feeder canal, generally carrying between 1,000-5,000 cusecs
chak | lowest order of irrigation command (about 162 ha); the watercourse is the irrigation distribution system in a chak; this term is also used to refer to a village
cultivable commanded area | gross area of land within a watercourse minus land occupied by homesteads, graveyards, or ponds
fasalana | illegal payment in the form of tips or bribes
jalar | a waterlift which is operated by a team of bullocks or a single camel which walks in a continuous circle to power the device which lifts water from the canal to the field
katcha | earthen
katcha nakka | cut outlet in earthen ditch bank
katcha warabandi | the rotation system in which farmers establish their own system for distributing water
kava | outlet from civil canal to W/C (NWFP)
hal | watercourse (W/C) (see below)
main canal | channel with carrying capacity of about 5,000 cusecs
minor distributary | tertiary from a branch canal carrying less than 1,000 cusecs, with discharges through a mogha of less than 100 cusecs; a minor distributary is the smallest channel under control of a Provincial Irrigation Department (PID)
mogha | uncontrolled outlet of specified gauge from a distributary to a chak
munsif | local villager (NWFP) who is responsible for reminding each farmer that his irrigation turn is about to start; is paid by each farmer
nakka | single point of water supply onto a farmer’s field
pakka | concrete
pakka nakka | permanent (masonry or concrete) outlet
pakka warabandi | the rotation system regulated by the Provincial Irrigation Department
sarkari khal | communal portion of watercourse
warabandi | system by which irrigation water is made available in rotated turns to farmers on a weekly basis, on certain days at certain hours, with a specified number of minutes of water flow (based on number of acres owned by farmer)
watercourse | the system of ditches conveying and distributing irrigation water from a single mogha or canal outlet to farmers’ fields, and not maintained at the cost of the provincial government
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