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MISSION TO PAKISTAN AND AFGHANISTAN

PROJECT ASSISTANCE COMPLETION REPORT

Irrigation Systems Management
(391-0467)

Submitted by Agriculture and Rural Development Division
October 1994

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LIST OF ACRONYMS

AID	--	Agency for International Development
AC&E	--	Agricultural Commodities and Equipment Program
ACOP	--	Alluvial Channels Observation Project (WAPDA)
ADP	--	Annual Development Program
ASSP	--	Agriculture Sector Support Project
CWM	--	Command Water Management Project
DRIP	--	Drainage and Reclamation Institute of Pakistan
FCC	--	Federal Coordination Cell
GOP	--	Government of Pakistan
HDC	--	Hydraulic Design Criteria
IBRD	--	International Bank for Reconstruction & Development (World Bank).
IIMI	--	International Irrigation Management Institute
ISM	--	Irrigation Systems Management Project (No. 391-0467)
LIM	--	Lower Indus Water Management & Reclamation Research Project
O&M	--	Operation and Maintenance
OFWM	--	On-Farm Water Management Project (No. 391-0413)
PACD	--	Project Assistance Completion Date
PARC	--	Pakistan Agricultural Research Council
PCRWR	--	Pakistan Council for Research in Water Resources
PID	--	Provincial Irrigation Department
P&I	--	Planning and Investigation
USAID	--	United States Agency for International Development
WAPDA	--	Water and Power Development Authority
WB	--	World Bank
WMED	--	Watercourse Monitoring and Evaluation Directorate (WAPDA)
WUA	--	Water Users Association

PROJECT ASSISTANCE COMPLETION REPORT

IRRIGATION SYSTEMS MANAGEMENT PROJECT (391-0467)

OCTOBER, 1994

I. BASIC PROJECT DATA

Project Title and Number:	Irrigation Systems Management (ISM); 391-0467
Date of Authorization: Date of Original Agreement: Original PACD: Revised PACD:	May 5, 1983 June 5, 1983 April 30, 1990 June 4, 1993 Dec. 31, 1993 (for procurement and installation of Warsak Pumping Station equipment only)
Amount Authorized: Amount Obligated: Pressler Deobligations: Net Obligations: Total Expenditures:	$ 205,000,000 $ 122,900,000 $ 5,458,822 $ 117,441,178 (as of 09/30/94) $ 116,507,949 (as of 09/30/94)
Grantees' Authorized Representatives:	1. Secretary, Ministry of Finance and Economic Affairs 2. Chief Eng. Advisor, Chairman Fed'l Flood Comm. 3. Fed'l Coordinator for ISM, Ministry of Water & Power 4. Provincial Coordinators in the four provincials PIDs
Implementing Agencies:	1. Ministry of Water and Power, Government of Pakistan 2. Provincial Irrigation and Power Department, Punjab 3. Provincial Irrigation and Power Department, NWFP 4. Provincial Irrigation and Power Department, Sindh 5. Provincial Irrigation and Power Depart, Balochistan
Other Line Agencies/ Departments:	6. WAPDA & its subsidiary agencies a. MONA sub-project at Bhalwal b. LIM at Hyderabad/Sindh c. WM&EDirectorate/Lahore d. P&I/WAPDA, Lahore. e. ACOP, Lahore. 7. Pakistan Agricultural Research Council 8. Pakistan Council for Research in Water Resources 9. Drainage and Reclamation Institute of Pakistan
Technical Assistance Contractors:	1. PRC/Checchi, (Inc.) 2. Harza Engineering Company 3. ARD, Inc. 4. University of Idaho
USAID Project Officer:	Muzammil Qureshi

II. PROJECT GOAL AND PURPOSE

Original:

The project goal was to increase agricultural production and farmer income by improving the management of irrigation water resources.

The purpose of the project was to increase the capabilities of institutions involved in irrigation planning, design, research, operation and maintenance, and to bring about policy changes needed for proper irrigation water management.

Revised:

The revised project goal was to increase agricultural productivity and production through more efficient, reliable and equitable distribution of water.

The revised project purpose was to assist the four Provincial Irrigation Departments (PIDs) and the Federal Coordination Cell to develop capacity for sustained and proper operation, maintenance and management of the rehabilitated irrigation system.

End of Project Status (EOPS) targetted at the design stage included the following :

Rehabilitation of Canals and Drains Component

A. Canal system is rehabilitated such that future operation and maintenance problems are minimized.

B. Canal free-board is maintained on rehabilitated canals.

C. Water charges are increased and rationalized such that these are more in line with the maintenance cost of the system.

D. Adequate funding is available for operation and maintenance through increased water rates, reduced expenditures for publicly owned tubewells and/or other financial arrangements.

E. Provincial Irrigation Departments capabilities are improved by trained staff and additional equipment.

F. Prompt disposal of surface water by rehabilitated drains.

Irrigation Systems Management Research Component

A. Improved research capabilities established in the following institutions:

(1) Punjab Irrigation Research Institute.

(2) Hydrology and systems analysis organizations of Water and Power Development Authority (WAPDA).
(3) Central Monitoring Organization, WAPDA.
(4) Mona Reclamation Experimental Project, Punjab.
(5) Lower Indus Water Management and Reclamation Research Project, Sindh.
(6) Sindh Hydraulic Research Station.

B. Water charges are increased and rationalized such that these are more in line with the water use.

C. Adequate funding is available for O&M through increased water rates, reduced expenditures for publicly owned tubewells and/or other financial arrangements.

D. Canal free board is maintained on rehabilitated canals.

Command Water Management Component

A. Implement one Command Water Management pilot program in each Province to assess feasibility of this concept.

Institutional Development Component

A. Increase the capabilities of institutions involved in irrigation planning, design, research, operation and maintenance and bring about policy change needed for proper irrigation water management.

B. Institutionalize in-service training programs in the institutions in the water resources sector.

C. Install improved planning, design and water management capabilities in the government organizations.

III. Background

A. Country Setting

(1) Irrigation System in Pakistan: Pakistan has the third largest contiguous irrigation system in the world. From the Indus River and its tributaries run a network of canals totalling about 40,000 miles, which in turn, feed an additional 250,000 miles of public watercourses. If farmers' watercourses or field ditches are added, the system totals well over a million miles. The system includes more than 200,000 tubewells, of which about 13,000 are publicly-owned. The system serves a total cultivable command area of 34 million acres.

In addition to its size, the Indus Basin area is characterized by very low land scope, high sediment loads, salinity of much of its ground water, a semi-monsoon climate, and wide cultural heterogeneity among its users. These features, as well as the history of Pakistan's

irrigation strategy, have given rise to the technical and institutional issues the ISM Project was designed to address.

Outside the Indus Basin, in Balochistan, the NWFP, and the Federally Administrated Tribal Areas, irrigation is fairly common, but on a smaller scale and more widely scattered and closely tailored to the unique geography of these regions.

(2) Pakistan's Irrigation Strategy: Since independence, Pakistan's strategy for the Indus Basin has focused on : (a) conservation of water and redesign of the conveyance system to counter the effects of the division of rivers under the Indus Basin Treaty (the Indus Basin Project); (b) reclamation and control of salinity and waterlogging (the SCARP Projects); and, (c) improvement in the delivery of water to farmers' fields (the On-Farm Water Management Projects). As reflected in its 1979 Revised Action Program for Irrigated Agriculture (RAP), the Government has adopted a strategy of removing technical constraints to water deliveries and managing water resources in the context of the overall package of inputs and services which farmers require to increase their incomes and production.

(3) Institutional Setting: A number of key policy makers in federal ministries are concerned with development of the agricultural sector, including the land, water and infrastructure that support this activity. Those most directly involved include the Special Agricultural Advisor to the Prime Minister and key administrators in the Ministries of Planning and Development; Finance and Economic Affairs; Food, Agriculture and Cooperatives; and Water and Power. Policy is implemented through the Five Year Plans and annual allocations to the development and non-development budgets of each Ministry and the Provincial Governments. Most aspects of irrigation policy and some program aspects are carried out by the federal ministries and their agencies, such as WAPDA in Ministry of Water and Power, and others through Provincial agencies such as the Provincial Irrigation Departments.

B. The Original Project

The original ISM Project was designed to assure reliable and equitable water supplies by physically rehabilitating Pakistan's irrigation and drainage system and improving concerned institutions. The project was approved on May 5, 1983 with LOP funding of $65 million and a PACD of April 30, 1990.

Prior to the project, a combination of factors created a crisis situation. On one hand, the completion of major link canals increased the total supply of water in the system. On the other hand, the system had deteriorated to a point where water distribution was increasingly unreliable and inequitable. Additionally, over-toppings and breaches of canals caused damage to crops and households; and increased water supplies were captured by head-enders, while tail-enders received uncertain and irregular supplies. Through the system, inadequate or poorly functioning drains failed to remove seasonal water surpluses or raised groundwater tables.

The project's original purpose was to rehabilitate the system and establish appropriate funding levels, funding mechanisms, and operations and maintenance procedures and practices to keep

the system in its improved state. The project was designed with four components; (1) Rehabilitation Works, (2) Institutional, Management and Technical Skill Improvement, (3) Planning, Policy Implementation, and Research, and (4) Command Water Management (CWM).

C. Amendment for the inclusion of CWM Component

The original project included the CWM component only to complete a feasibility study and it was planned that after the assessment of the findings of the study, the project paper will be amended to define in detail the activities of this component.

The project paper amendment was approved on February 19, 1985 for the CWM component which increased the LOP funding by $25 million to a new total of $90 million. The objective of this component was to help achieve the overall purpose of the ISM Project by strengthening the management of existing institutions, infrastructure, agricultural inputs, and services in an integrated and collaborative manner in order to remove the major constraints to increased irrigated agricultural production in selected sub-project areas.

D. The ISM-II Project

This amendment built upon and refined the substantial achievements made in ISM-I. It took advantage of mistakes made and lessons learned in the design and implementation of that project and led closer to USAID's longstanding objectives for the irrigation sector - efficient and effective Provincial Irrigation Departments, delivering water in response to the farmers' needs for their crops and removing the excess through an efficient system of drains. The ISM-II was authorized on February 2, 1989 which increased the LOP funding by $115 million to a new total of $205 million with a revised PACD of June 4, 1993.

A principal difference between ISM-II and its predecessor is that ISM-II treated the four Provincial Irrigation Departments (PIDs) as separate and distinct entities, each the beneficiary of a discrete package of interventions. The earlier projects likewise dealt with all four PIDs, but it did not articulate or respond to differences in capabilities, organizational set-ups, traditions, hydraulic and agronomic conditions and requirements existing between the four provinces.

This amendment was tailored to the unique requirements of the irrigation systems and organizations of the four provinces, and the Federal Government. The interventions are presented as a single project for the sake of brevity and clarity, but they were the result of distinct sets of requirements reflecting the differences between the provinces.

E. Effects of Pressler Amendment

After the imposition of the Pressler Amendment in 1991, additional funding of the ISM Project was halted. Later, when the Mission was required to rescind $56.2 million from the Pakistan program, $3.8 million was deobligated from the Project to contribute toward the required rescission level. The Project, which was originally conceived to cost $205.0 million, ended up with expenditures of only $116.5 million.

In the case of project activities, only those which were already in progress were allowed to be completed. While nearly all the Project interventions were ultimately completed, several were substantially reduced in size. There was no change in the Project Assistance Completion Date (PACD) of June 4, 1993, except for one activity - Installation of Electric Motors and Switchgear at the Warsak Lift Canal Pump House in the NWFP, which could not be completed owing to late delivery of the equipment by a U.S.A.-based vendor. The PACD only for this activity was extended to December 31, 1994.

IV. PROJECT COMPONENTS

The Irrigation Systems Management Project was designed as an umbrella project with four major components which are described below:

Irrigation Systems Rehabilitation

This component was co-financed by the World Bank and USAID and later, the Dutch Government joined in. The purpose of this Project component was to rehabilitate the irrigation and drainage systems in all the four Provinces of Pakistan, which had badly deteriorated due to deferred maintenance owing to shortage of Operation and Maintenance funding for this purpose. The World Bank and Dutch Government funds were mainly used for the rehabilitation of the irrigation infrastructure. USAID mainly financed the institutional development component of the Project. A very large team of institutional development consultants, PRC/Checchi was fielded for the first five years of the Project and later, a contract was entered into with another consulting firm, Harza Engineering, to work on an extensive institutional development program. NESPAK was the Pakistani consulting firm assisting in the rehabilitation program.

Command Water Management (CWM)

This component branched off from the main Irrigation Systems Management Project in February 1985 through a Project Amendment. As stated above, a separate Project Paper was developed for this component. Likewise, this component had a separate Project Officer and Project staff, as well as a separate institutional development team, ARD, Inc. The local consulting firm was Associated Consulting Engineers (Pvt.) Limited. The objective of this Component was to pursue the concept of On-Farm Water Management, an endeavor which USAID and other donor agencies had been participating in for a substantial period. The idea was to improve the management of water, as well as non-water agricultural inputs, at the farm level to increase crop yields. Certain distributary/minor canal commands were selected as sites for implementation - four in the Punjab Province, and one each in Sindh, Balochistan and North West Frontier Provinces. The Distributary/Minor canals were rehabilitated and lined with the World Bank funding while the improvement of watercourses and institutional development were financed by USAID.

Irrigation Systems Management Research

The objective of this component was to improve the research capabilities of the organizations conducting irrigation systems research. The Project supported the establishment of new, and improvement of existing organizations engaged in such research. Enhancements of these organizations included: improvement of laboratories in Sindh; provision of necessary equipment; training staff through graduate and post-graduate study in the USA; and steering a number of research projects to completion through these organizations. This component had an approved paper and a separate Project Officer. Technical assistance for this component was carried out by the University of Idaho.

Institutional Development

The objective of this component was to establish institutional improvements in the organizations, systems and procedures in the government departments managing the irrigation infrastructure, on-farm improvement effort and research in the water resources sector. For each one of the above three components there were separate Technical Assistance contracts funded by USAID to implement this component.

V. INPUTS

U.S. $122,900,000 was obligated for implementation of the Irrigation Systems Management Project as a whole. $5.5 million were later rescinded from the project as part of total rescission of $56.2 million from the Mission. The final obligation was $117,441,178. The funds were earmarked for activities under the different components of the Project on as-needed basis. Following are the details of funds obligated/expended by USAID, other donors, and the Government of Pakistan for implementation of the Irrigation Systems Management Project.

USAID (ISM Project)

Project Line Items	Obligation	Expenditure (As of 9/30/94)
Technical Assistance	39,755,604	39,755,604
Training	13,872,773	12,939,544
Commodities	17,146,711	17,146,711
Other Costs	37,509,446	37,509,446
Civil Works/Construction	8,802,962	8,802,962
Evaluation	353,682	353,682
TOTAL:	117,441,178	116,507,949

Other Costs and Civil Works/Construction line items were utilized for the rehabilitation of canals and drains.

Other USAID/Pakistan Projects

Three other projects/programs in the USAID/Pakistan portfolio contributed to the objectives of the ISM Project. This additional funding is broken out below:

Agricultural Commodities and Equipment Program (391-0468): The purpose of the ACE contribution to the ISM project was to replenish inadequate and obsolete workshop, earthmoving and construction equipment and machines in the four provincial PIDs.

Description	U.S. Dollars
1. Heavy Construction Machinery	33,131,000
2. Workshop Machinery	7,865,000
3. Light Equipment for Canal Maintenance	726,000
4. Equipment for Warsak Lift Canal	1,290,000
5. Computers	152,000
6. Vehicles	770,000
TOTAL:	43,934,000

Agriculture Sector Support Program (391-0492): This program financed only the overseas training of the GOP participants, who were still in the process of completing their long-term training when the ISM Project funds were cut off on its PACD. Total funds expended for the ISM Project were $ 1,543,642.

Project Design and Implementation Fund (391-0470): A total of $170,469 was received by this project, mainly to support short-term technical assistance.

Other Donors

International Bank of Reconstruction and Development (IBRD)	
Funds Authorized for the Irrigation Systems Rehabilitation (ISR) Project:	$ 166,000,000
Total funds expended:	$ 140,507,000
Funds for the Rehabilitation Component	
Authorized:	$ 119,500,000
Expended:	$ 83,577,000
Funds for the Command Water Management Component	
Originally Authorized:	$ 46,500,000
Amended Authority:	$ 56,930,000
Expended:	$ 56,930,000
Dutch Government	
Funds Authorized for the ISR Project:	G 16,000,000
Total Funds Expended:	G 5,730,000
Government of Pakistan	
Funds Authorized for the four Components:	Rs. 672,259,000
Total Funds Expended:	Rs. 672,259,000

VI. PROJECT ACCOMPLISHMENTS

The Project, on the whole, was able to achieve most of its targets. The sustainability of the achievements is, however, another question, which is dicussed later. The institutional development component was fundamental to the Project. Aside from the physical contribution it was able to make, it brought about a significant change in the minds and attitudes of the GOP policy-makers towards not only the irrigation sector but in the entire agricultural sector. When the Project started, it seemed that even a slight change in the state of affairs of the irrigation sector would be difficult to achieve. Now at the end of this project, the GOP policy-makers are ready to take steps to modernize this sector. There is now a general agreement on the need to privatize, democratize and rationalize the functioning of the system. Steps are being taken at the various echelons of the GOP bureaucracy to move in this direction. This change in the thinking and attitudes of the counterpart agencies was brought about through persistant dialogue on the necessity of making fundamental changes in order to make a breakthrough in the water resources sector. It would be, however, presumptuous to expect that all hurdles have been removed in this area. There are strong vested interests still in existence which stand in the way of a major change, but there is a sympathetic ear in the Government, which would be willing to take limited initiatives in the field.

Irrigation Systems Rehabilitation

The following accomplishments were made in the physical infrastructure of the irrigation system and in the functioning of the line agencies managing the system:

A. Rehabilitation of Canals and Drains:

1,581 kilometers of canals and 5,500 kilometers of drains were rehabilitated with USAID funding assistance. The following is a breakup by province of the number of kilometers of canals and drains rehabilitated by USAID and other donors during the life of the project:

	Kilometers Rehabilitated (by Province)				Total
	Punjab	Sindh	NWFP	Balochistan	
USAID					
Canals	568	687	312	14	1,581
Drains	3,051	2,410	39	0	5,500
Other Donors					
Canals	10,065	4,909	1,648	383	17,005
Drains	887	453	145	0	1,485

The significant contribution of this effort is the fact that in the areas, where rehabilitation has been carried out, the tail enders in canal system have started to receive their share of water. The drains clearance has improved substantial agricultural areas by facilitating drainage of the land. In many cases, where farmers had migrated owing to the water logging of their fields have returned and are engaged in the cultivation of their lands.

B. Improvement of Design Capabilities:

(1) Hydraulic and Sedimentation Data Collection Capability: A system of collecting hydraulic and sedimentation data on canals was established in the four Provincial Irrigation Departments through the provision of suitable equipment to them and by training their personnel in data collection techniques. This data is needed for the redesign of the canals, which is so essential for their upkeep, meintenance and efficient performance.

(2) Computer-Aided Design Capability: After extensive research, hydraulic design criteria were established for the irrigation channels of Indus reverine system. In order to modernize the design capabilities in the Punjab and Sindh, design offices were set up and equipped for computer-aided design work. The staff of the irrigation departments received training (both in-country and abroad) to become proficient in computer-aided design. The other two provinces - the NWFP and Balochistan, have traditionally either depended on the Punjab or private sector consultants for their design work. This arrangement was considered more in line with economy and private sector development and was encouraged. A setback was

experienced when the Punjab Irrigation Department did not accept the design criteria developed by the technical assistance team. The technical team design group worked with the Punjab Irrigation Department to address their concerns. The result of this interaction was the development of a wider scope of design parameters, which were adopted to the satisfaction of the engineers of the Punjab Irrigation Department.

(3) Redesign of Irrigation Channels: The Irrigation Department's Manual of Irrigation Practice requires that all channels be redesigned every five years, a practice which has not been followed. By establishing within the PIDs the institutional capability to collect hydraulic and sedimentation data and to perform computer-aided designs conforming to the newly developed design criteria, the task of performing periodic design reviews has been vastly simplified. These regular redesigns should result in substantial decrease of Operation and Maintenance (O&M) Costs of the enormous Indus Basin Irrigation System, as a redesigned canal re-establishes its regime of non-sitting and non-erosion performance.

C. Improvement in Operation and Maintenance:

(1) Operation and Maintenance Manuals: One of the most important Project objectives was to insure that irrigation infrastructure receives adequate repair and maintenance so that it does not deteriorate to the extent that another major rehabilitation effort is needed again. Towards this end, O&M Manuals were prepared containing general guidelines for maintaining the canals rehabilitated under the Project for use by the PIDs. The initial intent of the Project team had been to provide more specific, detailed requirements for O&M; however, the PIDs did not agree to this more elaborate undertaking. Subsequently, general O&M manuals were prepared for Sindh and Balochistan and handed over to them.

(2) O&M Cost Yardsticks: Elaborate yardsticks for the O&M costs for all of the irrigation facilities in each Province were either prepared or updated. These provided to the Provinces a proper method of preparing O&M cost estimates to serve as the basis for requests for the allotment of adequate funds.

(3) Allotment of O&M Funds: During the Project, donors ensured that adequate O&M funds were made available to the PIDs from the provincial governments to maintain a satisfactory O&M standard of the irrigation system. As the GOP has always been under budgetary constraints, we are not sure whether the level of funding for adequate O&M of the irrigation system will continue in the future.

(4) Cost Recovery of the O&M: A very important objective of the Project was to institutionalize a system of cost recovery which would produce revenues sufficient to cover all O&M costs. The present system produces revenues which are far below the actual O&M expenditures. Towards this end a comprehensive study was conducted and a report was prepared providing answers to many questions on this issue. It was determined that the water users/farmers had the capacity and willingness to pay higher charges for water/irrigation services. They, however, demanded reliable and equitable water supplies in return. Based on the recommendations in this report, donors carried out extensive negotiations with the GOP and a plan for full O&M cost recovery was prepared under which full cost recovery would be

reached by 1997. During the Project, the donors made efforts to enforce cost recovery in accordance with the agreed schedule with partial success. As the political field is dominated by an agriculturist feudal society, it is doubtful if the full cost recovery system will be fully implemented per the planned schedule.

D. Improving Institutional Capabilities of Line Agencies:

(1) Computerization: In order to modernize the functioning of the PIDs and enhance their efficiency, PID field offices were equipped with computer equipment. The staff to man these offices was trained in an extensive training program and these offices were made fully functional. The PIDs started to enter extensive data related to their functions in the computers and started making good use of them for the management of the system. The most outstanding use of the computers was made in the preparation of O&M Plans, cost estimates, and preparation of budgets. The budget estimates prepared thus far have been so convincing that the Finance Departments had little excuse not to appreciate the funding needs and accommodate them to their best capability.

(2) Human Resources Development Cells: These cells were set up in all the PID Secretariats to store data on all categories of employees. These data were then used to plan the employees postings and transfers and their in-service training needs.

(3) Management Information Flow Centers: In order to collect, collate, and disseminate management information in an effective manner which ensures that it is used in the planning process, these centers were set up in all the four PIDs.

(4) Government Engineering Academy at Lahore: This Academy caters to the in-service training needs of not only the Punjab PID, but other PIDs as well. Extensive training of PID personnel was conducted at the Academy with Project funds in order to improve the skills of the staff of the PID in areas of professional weakness. This was in addition to the normal training which is conducted at the Academy during normal periods of operation. In return for the training services, the Project undertook to enhance the capability of the Academy by providing to them training aids and equipment, technical books and journals, transport and computers, etc.

(5) Alluvial Channels Observation Project (ACOP), Water and Power Development Authority (WAPDA): This organization is charged with responsibility for river and canal hudraulic, sedimentation and morphological data collection. A program of extensive training was conducted by ACOP under the Project to train the PID staff to acquire this data collection and analysis capability. In return, the Project provided laboratory and other equipment, transport vehicles and computers to ACOP to enhance its capabilities.

(6) Drainage Manual: There is some technical guidance available in the manuals of the PIDs on the design and maintenance of canals, embankments, and hydraulic structures. However, only very brief instructions are available on drainage. As the drainage is now a major problem in Pakistan and very large drainage projects such as Left Bank Outfall Drain are under construction, it was considered necessary to develop a Drainage Manual for adoption in the PID. This task was completed with the involvement of the PIDs in the last year of the Project.

E. Improving Mechanical Engineering Capacity of Line Agencies:

(1) Construction Equipment: The PIDs traditionally hold a fleet of construction equipment for the following purposes:

- Construction works
- Heavy O&M work
- Flood damages restoration work
- Mending canal breaches, etc.

At the start of the Project, the equipment in these fleets was as old as 20 years and most of the machinery was either out of order or in an unreliable condition. With funding from the Agricultural Commodities and Equipment (AC&E) Project (391-0468), construction equipment along with spare parts sufficient for 5 years of operation were imported and provided to the PIDs. The staff of the PIDs were trained through an extensive program of training on proper methods of operating and maintaining the imported equipment, an area where the PIDs had been seriously deficient. This machinery is used in the rehabilitation of drains for which there is no alternative to using heavy construction equipment. Also during the three large scale floods in Pakistan in this period, this machinery was of great help in restoring the damaged irrigation system in record time.

(2) Irrigation Workshops: Irrigation Workshops in the Provinces are used for:

- Fabrication of canal gates and gearing of the system
- Repair/overhaul of departmental construction equipment and vehicles
- Installation and upkeep of irrigation tubewells

The Project undertook to upgrade six Workshops, three in the Punjab and one in each of the other Provinces to ensure their adequacy in meeting their functional requirements. The Workshop machinery was imported with funding from the AC&E Project.

(3) O&M Equipment: The construction equipment is traditionally used for maintaining drains and for heavy O&M work on canals, such as desilting of beds and bank building works. However, for normal day-to-day maintenance, manual methods are used. Owing to change in the social practices, the O&M work on day to day basis does not meet with the standards of upkeep of the canal structures. In the Project evaluation report of January 1988, at the end of the first phase of the Project, a system of O&M was recommended which was based on the use of light equipment consisting of an agricultural tractor, its implements and some light transport vehicles. In Phase-II, this concept was implemented on a pilot basis. At the end of the trial period, the pilot exercise was evaluated and found to be highly effective. However, in the meantime, the Project funding was curtailed because of the Pressler Amendment and no further procurement of this type of equipment was carried out.

(4) Construction Equipment Overhaul Plan: A comprehensive program to overhaul the construction equipment held by the four PIDs was part of the Project. This was aimed at restoring to operating condition a large fleet of equipment which was lying deadlined due to inadequate funds for the necessary spare parts. This program of rehabilitation was greatly curtailed owing to the funding freeze which followed the Pressler Amendment. However, that

part of the program which was completed was very successful. The spare parts were provided with USAID Project funding and all other local expenses were borne by the GOP. The effort resulted in salvaging some very useful items of construction equipment which further strengthened the capability of the PIDs in construction work.

(5) Equipment Management System: Many initiatives were instituted to improve the equipment management capabilities of the PIDs. The most significant of these was the acquisition and installation of a computer program, called Main Saver, in the machine shops of the PIDs, the spare parts warehouses, and in the management offices controlling the construction equipment in each PID. This program enabled the PIDs to automate the records relating to construction equipment overhaul/repair; maintenance scheduling; spare parts inventorying, stocking and warehousing needs; and programming of workshops capabilities in handling the load of work. This program had to be adapted to the conditions obtaining in the PIDs in Pakistan and the staff of PIDs were trained in the proper operation of the system.

(6) Fabrication and Repair of Canal Gates and Gearing: The immense irrigation network in Pakistan has a large number of canal barrages and steel structures. The irrigation workshops had some capability to manufacture gates and gearing for these structures. As a first step, this capacity was improved wherever it existed and was created in the machine shops where it did not exist. The foundry facilities were upgraded and the staff was trained in metallurgy to ensure proper casting techniques and to achieve the desired strength of metallic structures. Also, there are steel members which are either fixed or embedded in the concrete/masonry structures of the barrages. Owing to uneven wear and tear of these members, the operation and movement of gates and gearing was not smooth and at times the steel gates got stuck in the barrages. This posed a serious threat to the stability of the barrages, particularly during periods of flooding. Equipment and methodology was developed by the PIDs to repair the steel components of the control structures. USAID provided funds for the rehabilitation of repairs to gates and gearing of a few of these structures, which provided a chance for the PIDs to complete these tasks, giving them confidence to tackle the rehabilitation of such works on their own. There are a vast number of barrages in Pakistan which are in crying need of rehabilitation. But for Pressler restrictions, USAID would have made an impressive contribution to this work.

Institutional Development

A. Technical Assistance: During the Phase-I of the ISM Project, a large technical assistance team by the contractor (PRC/Checchi) was fielded to work on a very elaborate agenda of institutional development. Owing to its large size, it took some time before an orderliness could be brought to their functioning. Even after that the team faced difficulties in working on topics on which there was lack of agreement between the team members and the Project counterparts. Also, there was lack of coordination between the two sides. The team, however, produced useful reports on eight topics of institutional development, which were identified as areas needing attention. Most of the recommendations in these reports were adopted and implemented either as such or with certain modifications. Adoption of whatever part of recommendations was accepted by the counterparts, was an uphill task for the Project staff as most of the TA work had been completed without the involvement of the counterpart agencies. During Phase-II of the ISM Project, the TA team of Harza Engineering was assigned mainly the

task of Project coordination by placing a coordinator in each Province for not so much of institutional improvement but to facilitate the Project initiatives implementation. Through short-term consultants they provided useful input in coordinating and facilitating activities like rehabilitation of gates and gearing of canal barrages, equipment overhaul program, induction of light mechanical equipment for canal maintenance and production of drainage manual. TA contractors ARD, Inc. provided assistance in the CWM component. They too made useful contribution in facilitating the implementation of basic command water management concepts in the pilot command areas in which the Project activities were accomplished. University of Idaho team provided technical assistance to the ISM Research effort. They were helpful in identifying needs and deficiencies in the existing research facilities in the water resources sector and in the implementation of plans to make up the deficiencies.

B. Human Resources Development: A program of extensive training of the personnel of Project counterparts was undertaken in this Project. This included both overseas (mostly in the USA) as well as in-country training. Details of the personnel trained during the Project is as follows :

	Overseas	Incountry
PHD	13	0
M.S. :	78	0
B.S. :	91	0
Short Courses:	549	2,590

The graduate and post graduate courses were helpful in making up of deficiencies in the research and design establishments of the insitutions in the field of water resources management. The short courses helped in strengthening the technical training base of junior field staff, particularly in the provinces of Balochistan and NWFP. The short courses in the U.S. were very useful in exposing the participants to a new world and new ideas/technologies available to a modern system which was working well. In many cases, however, the benefit of this training to the institutions in Pakistan remained questionable, when the participants close to their retirements were able to get themselves deputed on such courses for more than once.

Note: The above training data covers all the components of the ISM Project i.e., Rehabilitation, Institutional Development, Command Water Management, and ISM/Research.

Command Water Management

A. Civil Works:

Completed rehabilitation of 1,351 watercourses, setting up of over 1000 agricultural demonstration plots, precision land levelling of 20,000 acres of agricultural fields, setting up of 8 weather stations and 48 water level recording stations and rehabilitation/construction of demonstration field drains. All these activities resulted in making useful contribution to adoption of on farm agricultural practices in the pilot areas, which would result in the increased agricultural output.

B. Water Users Associations:

Over 1000 Water Users Associations (WUAs) were set up. The setting up of WUAs is fundamental to the implementation of command/on-farm water management concept. In a country like Pakistan, where there is a strong hold of bureaucracy on the resources which impact the agricultural output, the need for induction of the farmer community to manage their affair is of paramount importance. How successful this effort proved in the Command Water Management initiative is discussed later in this report.

C. Water User Associations Federations:

Only in the case of two sub-project areas, Shahkot area in the Punjab Province and Warsak Lift Canal Area in the NWFP, the Water Users Associations federated into larger groups of farmers to form more effective pressure groups to influence the line agencies to provide better services to the farmers.

D. Other Project Interventions:

Numerous water management and agricultural techniques and improvement interventions were made in various sub-project areas primarily through the input of the technical assistance team. These interventions included: certified seed multiplication, use of fertilizers and pesticides, on-farm irrigation techniques, farm business and marketing techniques, availability of farm credit, cooperative procurement and use of farm machinery, conjective water use and modern agronomic practices.

E. Replacement of Pumps and Electric Motors of Warsak Lift Canal Pump House in NWFP:

In 1983, when the Project took off, the Siemens (German) sets of pumps and electric motors were 20 years old on this pump house. There were five of these sets, each pump with a capacity of 50 cusecs lifting water of 250 feet. When four of them were run (one kept as standby), they delivered 200 cusecs of water to the canal, which runs 40 miles and serves an agricultural area of 40,000 hectars. Whereas the electric motors were still functional, the pumps had started to give in. USAID undertook to replace the pumps from a U.S. based vendor. It, however, took five years to complete the procurement of pumps, in which time, the electric motors started to give in. Ultimately USAID decided to replace all the equipment consisting of electric motors, electric switch gear and pumps. At this juncture, the Warsak Lift started to run

four at almost half its capacity due to breakdown of half of the old equipment. The command area of the canal badly suffered due to the shortage of water. Many farmers turned to private tubewells for irrigation and some even migrated from the barren lands. This gave cause to a lot of unrest in the area. Being contiguous to Afghanistan and the local people traditionally armed with sophisticated small arms, it posed a threat to law and order in the area. The question of shortage of irrigation water was raised many times in the NWFP Provincial Legislative Assembly. Finally, when USAID was able to replace the old equipment and the water started to flow at full capacity in the Warsak Lift Canal, it brought a relief to the area. The project brought about great goodwill to the U.S. Government amongst the local people of NWFP. USAID can be rightly proud of its accomplishment in solving a very complicated problem to the satisfaction and relief of our counterparts.

ISM/Research

Significant accomplishments in the ISM/Research Component of the ISM Project were as follows:

A. Research Agenda:

Eight projects on important topics in water management were completed by the following research organizations in the water resources sector :

Organization	Topic of Research Project
Pakistan Agricultural Research Council (PARC) and Water and Power Development Authority.	Farm Water Management
Water and Power Development Authority (WAPDA)	Beyond Watercourse Improvement
Pakistan Council for Research in Water Resources (PCRWR)	Farmer Involvement in Water Management
WAPDA	Integrated Watercourse Management
WAPDA	Public and Private Tubewell Performance
WAPDA	Irrigation Systems Outside the Indus Basin
Drainage and Reclamation Institute of Pakistan (DRIP)	Surface Drainage and Water Table Control
WAPDA	Ground Water Models

B. Seminars and Workshops:

Held seminars and workshops to establish institutional procedures for dissemination of information from one research agency to other agencies for better coordination of research activities in the water resources sector.

C. Extension Services:

Emphasised institutional procedures for the Pakistani extension services to access the results of research in order to improve farm production.

D. NADLIN:

Assisted in establishing of National Documentation Center Library and Information Network (NADLIN), a computerized facility, which serves as the main source of research material from Pakistan and abroad in the field of water resource management.

E. Competitive Grants Program:

Conducted a program of competitive grants, which aimed at awarding research assignments to scientists and researchers from the private sector, universities and other institutions. This resulted into widening the base of research to a vast variety of research topics and also encouraged a wide group of researchers to come forward and participate in a research program.

F. Cooperative Agreement with IIMI:

Through a Collaborative/Cooperative Agreement with International Irrigation Management Institute (IIMI), a vast program of a very successful research work was conducted, which on the one hand financed the ongoing research by the IIMI and, on the other, supported completion of 22 research studies by Pakistani research organizations and institutes. IIMI in this case provided technical assistance for the program.

VII. MAJOR CONSTRAINTS, PROBLEMS AND IMPEDIMENTS

A. *Imposition of the Pressler Amendment*

The imposition of the Pressler Amendment was a major event which had a significant adverse effect on the Project outcome, particularly in the area of sustainability. U.S. efforts in support of the water sector had to be abandoned at a very crucial stage of policy dialogue with the GOP. Doubtless, some of the momentum toward adoption of policy reforms critical to achieving a breakthrough in agricultural productivity will be lost owing to closing down of the program in Pakistan.

B. *Project Impact Evaluation*

This activity was developed to assess the impact the Project had on the Project objective of increasing agricultural productivity of the Project area. The evaluation started with a lot of enthusiasm. WAPDA's Watercourse Monitoring and Evaluation Directorate and the Punjab Economic Research Institute were contracted to carry out the evaluation. Very reputable U.S. short-term consultants provided input in designing, improving and monitoring the method of evaluation. But, in the end, it was determined that the evaluation as designed would not arrive at realistic results. Furthermore, it did not appear that there was any other method by which a realistic evaluation could be carried out, due to the presence of numerous extraneous factors influencing agricultural productivity in the Project areas. The impact evaluation exercise was therefore abandoned at this stage.

VIII. LESSONS LEARNED

Basic Institutional Reform

For any development effort to be successful and sustainable, basic institutional reform in the concept of governance, democracy and organizational/functional change in the performance of bureaucracy in Pakistan is essential. At present :

A. The government is controlling or regulating almost every activity in the country. The private sector, the community groups, the farmers, and individuals are at the mercy of a very unsympathetic bureaucracy. As a result all individual efforts to have their problems addressed fall on deaf ears and are thus frustrated.

B The bureaucracy, structurally, is huge, unwieldy and thus inefficient. It gobbles up most of the already scarce funds in its salaries, benefits and maintenance and hence not much is left to divert towards the maintenance and upkeep of public facilities, which are in their charge. The result is that these facilities are constantly in the process of deterioration and when the situation gets close to danger mark, it requires a donor's help to restore them to normal as was the case in the ISM Project.

The first and most important lesson, which emerges from our experience is that we should carry out assessment of the institutional capability of the host country before we agree to development projects. This, no doubt, is a tall order. But we should insist on some basic reform in the institutional set up and functioning of our counterpart agencies. In the ISM Project, there was lack of cooperation by the functioning level Pakistani bureaucracy and our TA team, which resulted into substantial loss of effort.

Suitable Fields for Development

Since Pakistan has basically an agricultural economy, this field is suitable for development expenditures. The rehabilitation of irrigation infrastructure was a suitable area to emphasize in the present project. However, the effect of such work is lost in three to five years and unless the sustainability in this field is ensured, it yields results for a limited time. In the future, the effort should concentrate on initiatives aimed at saving water, which is becoming scarcer day-

by-day. The initiatives should consist of canal linings and on-farm water management. The linings save useful water and the on-farm water management, we hope, will bring about a change towards democratisation and privatization of water management and agricultural practices at farm level in the beginning and later carried to the highest level, i.e., canal system and command areas management.

Technical Assistance (TA)

International technical assistance from U.S.A. is more relevant in the third world countries like Pakistan in high tech projects like dams and power projects, of the nature of Tarbela, Mangla and Ghazi Bharotha. For projects like ISM, expatriate TA is unnecessary as there is a wide base of Pakistani professional, who have experience of these fields and many of them have completed graduate and post-graduate education in U.S.A. The expatriate consultants need orientation on conditions prevailing in Pakistan and sometime they are not able to solicit cooperation from the counterpart officials as happened during ISM Phase-I.

Training

In-country and overseas training were useful interventions. Training in USA should be limited to graduate and post-graduate levels. Short-courses often offer very little to learn. Certain participants nominated by the GOP departments, particularly for short-term training, were often not the best ones suited to benefit from the opportunity. In some cases they were old and close to retirement. In many cases individuals in the position of authority were nominated again and again, in violation of the GOP's own rules.

Commodities

A. Substantial quantities of construction and machine shop equipment were procured through procurement service agents, which did not prove to be the most efficient means of procurement. We found that the best way to procure the equipment through the GOP, with very close USAID monitoring.

B. In the future, donors should place emphasis on using the private sector in providing construction equipment and workshop support to the Provincial Irrigation Departments. The private sector is now quite active in the field of construction. They hold fleets of equipment, which can be utilized for construction on irrigation projects. The maintenance of irrigation workshops and equipment fleets, which is not cost effective in the public sector can, thus be done away with.

IX. SUSTAINABILITY

The Project has a very limited sustainability. Examination of various Project goals and objectives and Project inputs will show how much of them have a chance of any durable sustainability.

Irrigation Infrastructure Rehabilitation

The irrigation infrastructure was in a state of deterioration owing to the neglect of the maintenance for want of funds. In spite of the efforts of the donors to forcefully pursue the policy issues requiring full O&M cost recovery and adequate O&M funding, a satisfactory level of cost recovery was not achieved. During the life of the Project, the GOP provided adequate O&M funding in response to the donor pressure, however, it is questionable whether this will continue in the donors absence. The irrigation infrastructures will deteriorate at a fast rate in the face of lack of funds. The most effective way to effect permanent change would be to shift the custodianship of the facilities from the Irrigation Departments to the farmers. Unless this is done, the funds (if) generated from the full O&M cost recovery approach are likely to be spent on overhead to support the bureaucracy rather than on actual maintenance.

Water Users Associations

The farmer associations, which were set up at the watercourse level will, perhaps, continue to maintain the watercourses on a cooperative basis, they have not been able to achieve much in the direction of integrated agricultural development. There is a need to provide them powers to be more effective in addressing their needs and be less dependent on Pakistani bureaucracy. One of the ways to do this, is to organize them at canal command levels like city corporations with powers to levy and collect taxes and utilize them to the best interest of the farming communities they would represent. This would lead to democritization and privatization of the agricultural sector, without which there can be little hope for a break through in this sector.

Institutional Development

A substantial effort was put into numerous institutional development initiatives, which were introduced in the existing set up managing the irrigation sector. However, when it comes to financing them from the GOP resources, it is questionable whether these would be sustained or not. A major effort in computerization may wither away, when the replacement of equipment becomes necessary. Similarly, the construction and other equipment may be deadlined for the want of spare parts for which there would be no funding without a donor. The budgeting yard sticks and O&M guidelines may become irrelevant if the funding allocation is not going to fully cover these requirements.

X. SUMMARY OF RECOMMENDATIONS

It is recommended that future development projects funded by donors in the water sector should be along the following guidelines.

- The projects should be designed to finance a major facility of permanent value such as lining existing canals, construction of new irrigation projects, large or small dams, and on-farm management as part of integrated rural development.

- The equipment supplied in the Project and its spare parts should be locally available. Maximum dependence should be placed on the equipment leasing from the private sector.

- Basic reforms in the democratic institutions and governance are necessary for the success of any development activity and its sustainability. This aspect should be strongly negotiated before any donor assistance.

- The irrigation and agricultural sector has best chances of progressing, if it turned over to the farming communities for management. We should support projects, which are self managed by the users, who are vested with powers to take actions towards their sustainability.