INTERNATIONAL WATER MANAGEMENT INSTITUTE (IWMI) IN PAKISTAN

Introduction

Reflecting the broader CGIAR vision, IWMI's vision is ***Water for a Food Secure World***. The institute's mission focuses on its comparative advantage and specific niches : ***To improve the Management of Land and Water Resources for Food, Livelihoods and Nature***.

IWMI's research agenda is derived from a comprehensive analysis of the water and land related constraints to enhancing food production and improving rural livelihoods, in the wider context of the river basin. Its research aims to test promising technical, institutional and policy solutions to overcome these constraints, taking into account all aspects of water use in agriculture throughout the basin, their upstream-downstream interactions, and crucial interactions with the other main water using sub-sectors, i.e., municipalities, industry, and the environment as water moves through the landscape Based on the analyses, IWMI conducts applied and policy-oriented research centered around four themes:

1. Water Availability and Access

2. Productive Use of Water

3. Water Quality, Health and Environment

4. Water and Society

The centerpieces of IWMI's strategy in South Asia are as follows:

a) Develop and strengthen strategic partnerships within the region and internationally to exchange cutting-edge research based information and policy recommendations for effective management of water and land resources, and contribute to the Millennium Development Goal on hunger and poverty.

b) Develop water allocation processes that recognizes and preserves the rights and access to water for the poor

c) Undertake applied and policy-oriented research while effectively building on regional research capacity (NARES, universities, knowledge-based NGOs and civil society organizations),

d) Disseminate IWMI's and partners' outputs in order to achieve policy impact at a range of levels.

IWMI in Pakistan

IWMI's long presence in Pakistan and the strength of our partnerships place us in a unique position to address the most pressing water management challenges, particularly in the Indus basin. IWMI's niche is to promote water management tools and approaches that complement the Government's massive investment and development plans for canal lining, investments in High Efficiency Irrigation Systems, and much needed reforms to the rather obsolete institutional and organizational set-up for governing the country's massive irrigation systems. The water sector in Pakistan has recently received renewed attention from the Government as well as international donors; this provides an excellent opportunity for IWMI to strengthen our collaborative research programs in the country. In Pakistan, IWMI enjoys diplomatic immunity and privileges equivalent to other UN organizations.

Overview of Selected Research Projects Undertaken in Pakistan

1. Establishment of Farmer Organizations in the Sindh Province

In 1995, Government of Sindh invited IWMI to conduct an action research pilot project on Farmer Organization (FOs) in three distributaries. The main focus of this research was to test the viability of effective water user organizations to manage and operate the distributaries / minors. The project

achieved its target of organizing three FOs on three different distributaries in Left Bank Outfall Drain (LBOD) project area. Considering the success of these FOs, Government of Sindh extended the pilot project to facilitate these three FOs for the irrigation management transfer and to assist the farmers of ten more distributaries in the formation of FOs. The extended project started in 1999 to assist farmers in the pilot area, to explore how the three distributary level FOs and eighty Watercourse Associations (WCAs) in the pilot project can enhance their sustainability, and to organize 10 additional distributary. Under this project 11 (instead of 10 envisaged in TOR) additional FOs were formed. Thus the total number of FOs became fourteen and all these FOs were registered under SIDA.

2. Establishment of Water User Associations (WUAs) in Hakra 4-R Distributary in Punjab.
In 1994, IWMI signed an agreement with the Royal Dutch Government to experiment with a pilot project in the Fordwah Eastern Sadiqia Canal for the formation of Water User Associations (WUAs). For this purpose, Hakra-4-R distributary was selected. Under this project, 4500 water users residing in 41 villages were organized at watercourse level to form 121 Water User Associations (WUAs). These organizations were first form on an informal basis and then their formalization process was completed. This was the ground breaking work in the introduction of WUAs in Pakistan for the operation and maintenance of irrigation canals by farmers to ensure equity in water distribution and collection of water fee (abiana) from water users. This project also formulated regulations for these WUAs and developed TORs for their working with the existing irrigation department. The project also extended comprehensive training facility to farmers and irrigation department officials on different aspects of this new set up. The trainings for farmers included water measuring, book keeping, financial record keeping, operation and maintenance and other related aspects of canal management.

Pro-poor Intervention Strategies in Irrigated Agriculture in Asia (2001 – 2003; ADB Funded)
The Pakistan component of this project was carried out in Rechna and Chaj Doabs in collaboration with Faisalabad Agricultural University. The overall objective of this study was to promote and catalyze equitable economic growth in rural areas through pro-poor irrigation interventions in the participating developing member countries (including Bangladesh, People's Republic of China (PRC), India, Indonesia, Pakistan, and Viet Nam). The study also determined what can realistically be done to improve overall performance and sustainability of the established irrigation schemes. The outcome of this study was:

- Guidelines for pro-poor interventions and enabling policy and institutional framework for reducing poverty in low-productivity irrigated areas in Pakistan.

- Country-specific recommendations for a set of interventions and policy and; institutional framework to reduce poverty in selected low-productivity irrigated areas in Pakistan.

Impact Assessment of Infrastructure Development on Poverty Alleviation: Case Study on Irrigation Projects in Pakistan (May 2000 – March 2002; JBIC Funded)
The main objective of this study was to make an assessment of the economic impact of infrastructure development by using the concept of transient and chronic poverty. This study takes irrigation projects as a case study on the impact assessment.
The study outputs were:

- Impacts assessment of infrastructure development on poverty alleviation in Pakistan (taking JBIC financed projects as case study).

- Development of an analytical method to verify the impact of infrastructure development, especially on poverty alleviation.

Conjunctive Water Management for Sustainable Irrigated Agriculture in South Asia (January 1999 – June 2002; ACIAR Funded)
This project continues in collaboration with Pakistan Council for Research on Water Resources, Soil Salinity Research Institute etc funded by the Australian Center for International Agricultural Research.

The overall goal of the project is to identify combinations of institutional and technical strategies to manage surface and groundwater at regional scale to promote environmental sustainability and maximize productivity of water ('crop per drop'). The project is being implemented in the Rechna Doab in Pakistan and Murrumbidgee Region in Australia, simultaneously.

The output of this project yielded useful information on the technical feasibility of providing irrigation water of acceptable quality from multiple sources in a timely manner across an irrigated region and their environmental and financial consequences. The project also identified technical and institutional solutions for effective conjunctive water management in an irrigated area.

Pehur High Level Canal (ADB Funded)

At present there is relatively little activity on this project, which is funded by the Asian Development Bank. In the first phase of the project IWMI developed a set of operational models for use in the design of the Pehur High Level Canal which is currently under construction. The irrigation system is designed for a buried pipeline distribution system at secondary level, the first of its kind in Pakistan, and is intended to be operated to closely match irrigation deliveries to actual crop water demand. The second phase involved the testing and adoption of these models by operational staff of the North West Frontier Province Irrigation Department as soon as the main canal is completed.

Constrains to Land and Water Productivity of Wheat in Pakistan: A Comparative Analysis (ADB Funded; Oct. 2000 – May 2002)

The main focus of this project was to assess the productivity of water in Pakistan with particular emphasis on the productivity of rice-wheat cropping systems. It parallels a similar study being undertaken in northwest India. Through a series of detailed farm level measurements the project is assessing the irrigation practices of farmers using both canal supplies and groundwater, and determines yields in terms of both area and volume of water delivered. Data are also collected on the inputs used by each farmer so that the data can be readily compared with parallel studies conducted elsewhere. The project also examines the decision-making processes undertaken by farmers to try to determine which factors influence their decisions concerning management of water and crops as part of an effort to determine the impact of pricing and other policies regarding input and output use. This study provided a diagnostic methodology to improve water productivity in irrigated agriculture.

Remote Sensing and Irrigation Performance

Pakistan provides an excellent opportunity for continuing work in the use of remotely sensed data for assessing irrigation performance. This forms part of a wider initiative of IWMI to use surface energy balance equations to make estimations of actual evapotranspiration, soil moisture, biomass growth and other physical parameters that can assist irrigation managers in determining important aspects of performance. With more access to free remotely sensed data with a variety of resolutions it is possible to develop a more or less real time management system that allows performance to be assessed within the context of a single irrigation cycle. The project looked at further refining the estimation of the various performance parameters and linking them with secondary data within a GIS/MIS framework.

Sustaining Crop And Water Productivity in the Irrigated Rice-Wheat Systems of the Pakistan's Punjab (ADB Funded; Jan 2001 – Dec. 2003)

IWMI took lead in the coordination of the Pakistan component of ADB funded Project to evaluate the impact of conservation tillage in six different sites within the sub-continent. The Pakistan component being implemented in the Rechna Doab which is the heart of the rice-wheat belt of Pakistan is focusing on the assessment of water saving potential at field, farm and system levels through conservation tillage practices and different water management techniques. While plot level experiments indicate that substantial water savings can be made through use of zero tillage, raised beds and land leveling there is no data yet available on the extent to which these savings are cumulated upwards to sub-system or even system level within the irrigation canal commands. There is concern that some of the savings may be nominal, because they reduce seepage into groundwater that is then productively used by

neighboring farmers. Applying less water may reduce seepage and thus lead to reduced recharge of groundwater.

This project provided information on the impact of alternative rice and wheat crop management practices on land and water productivity. Costs and returns at the farm level will be quantified and compared with traditional practices. Dissemination of results was done through seminars/workshops and field demonstrations with considerable participation of farmers.

Decision Support System for Irrigated Agriculture

Geographic information systems provide the basis for compiling databases from several different sources and with different boundaries and scales of data collection. This project aimed at using such an approach to combine data from several different sources, including hydraulic data such as irrigation canal discharges, tubelwell density and operations, depth to groundwater, and groundwater quality; agricultural data on crops, cropping patterns, yields and productivity, remotely sensed data on irrigation performance, climatic, soil and topographic data, and sue this to develop a simple management information system that can help irrigation and agriculture managers make the best use of scarce water and land resources. This project focussed on two irrigation subdivisions in the southern portion of the Rechna Doab, and develop a database that not only speeds up data retrieval for managers in line with existing procedures but also enables them to combine different sets of data to gain a better understanding of conditions in the pilot areas.

During 2001, a framework for the decision support system has been designed. Secondary data of last ten years regarding irrigation and drainage, agriculture, weather is being collected from various agencies. Base maps for the benchmark basin (general features, Doab boundary, roads, railway track, population points, Water bodies, hydrological layouts, Civil administrative units, Irrigation administrative units) are being prepared in the GIS format.

Indus Basin Study

This activity continues to look at various elements of performance in the whole of the Indus Basin. It has focussed on the assessment of different performance parameters at canal command level, including variations in both supply and demand to each canal command, and demonstrates the considerable variability within the basin as a whole. The next stage of the project will be to make assessments on the technical feasibility of changing water allocations by canal command and assessing the extent to which such changes would result in improved performance at basin level. This will be done through a combination of hydraulic modeling to determine what opportunities exist for water reallocation, followed by use of production-based models to assess the changes in performance that might result.

Root Zone Salinity Management Using Fractional Skimming Wells with Pressurized Irrigation (March 1999 – Feb 2003; National Drainage Project, World Bank Funded)

This project looked at efforts to control salinity levels in soils and groundwater so that the negative impacts on irrigated agricultural production are minimized. The majority of the work focuses on the use of skimming tubewells that are designed to lift shallow layers of fresh groundwater to the surface without causing upconing of underlying saline water supplies. To make the most efficient use of this relatively limited freshwater resource, work also examines the appropriateness of pressurized irrigation systems with both sprinkler and drip technology, to minimize application losses at field level.

The study was carried out with funding provided by the National Drainage Program in Pakistan in collaboration with the Water Resources Research Institute and the Mona Project. Several tubewells have been included in the project and a new area in Fordwah Eastern Saddiqia Irrigation system will be developed this year.

The outcome of this study was the identification of promising technologies of fractional skimming well in the shallow fresh groundwater aquifers, to control salty groundwater upcoming phenomenon as a

consequence of pumping. The demonstration of these technologies will encourage the local manufacturers to develop low cost technologies adaptable for local conditions.

FUTURE THRUSTS

IWMI's involvement in countries with highly developed water resource sectors such as Pakistan should primarily be at the level of policy and institutions. We need to articulate a substantive policy thrust for large-scale irrigation and river basin management through the integrated management of water resources (IWRM). IWMI's program will increasingly address comprehensive and integrated management approaches encompassing both surface and groundwater resources in a river basin context. Similarly, research on institutions and policy support for larger water sector governance challenges, state-center relations, river basin management, and irrigation sector reforms, etc. will increasingly draw on multiple themes in IWMI's portfolio.