Pro-poor Interventions in Irrigated Agriculture

Issues, Options and Proposed Actions

Pakistan

Poverty-especially rural poverty-has risen during the 1990s in Pakistan. Plus, the benefits of irrigation have not been fully realized. Huge inequities in the distribution of land and water are hitting poor men and women hardest, and agricultural productivity is low, due to inadequate water supplies and a lack of access to other inputs. What's more, irrigation charges are low and not linked to the cost of operating and maintaining systems. Institutional and management reforms to increase farmer participation have been designed, but they are still mostly at the pilot stage, and progress in implementing them is slow.

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Introduction

Reducing poverty is a major development goal. But to achieve this, we need to answer some basic questions. What contribution does irrigated agriculture make to reducing poverty? How does the performance of irrigation systems impact upon poor men and women? Have recent irrigation reforms improved access to water and lifted the poor out of poverty? And, what practical actions will give the best return on investment in terms of alleviating poverty?

This briefing answers those questions in the context of Pakistan. It is one of a series produced by the project 'Pro-poor Intervention Strategies in Irrigated Agriculture in Asia',[1] which took a holistic approach to understanding poverty, in order to identify practical, pro-poor interventions. In-depth, multidisciplinary studies were carried out in each of six Asian countries, and primary data was collected from 5,408 households in 26 irrigation systems using a standard set of methods, to provide new insights that are valuable contributions to the fight against poverty.

Overview: Context and Country-specific Issues

Poverty in Pakistan worsened during the 1990s, mainly as a result of poor governance and slow economic growth. Between 1993 and 1999, the number of poor men and women rose by more than 12 million. By 2001, 32% of the country's people were living in poverty—though in rural areas the poverty rate was higher (39%). Per capita annual incomes remained low, reaching only US$420 in 2001.

Over 67% of the population live in rural areas and depend—directly or indirectly—on agriculture for their livelihoods. It contributes around a quarter of the country's gross domestic product (GDP), employs 44% of the labor force, and contributes significantly to export earnings. But, the country's rural economy has been caught in a vicious circle of problems, which are limiting efforts to cut poverty. A fast-growing (2.5% per year) population is reducing the resources available per person. This is compounded by low literacy levels, slow growth in both farm and non-farm sectors, and continuing poor governance. Plus resources, especially land, are very inequitably distributed. So, around 50% of rural households are landless, while only 7% of landowners own 40% of the country's agricultural land.

To aid agriculture, Pakistan has built a huge irrigation system—which includes 58,500 km of irrigation canals and 1.62 million km of watercourses. Plus, 530,000 tubewells are currently pumping groundwater for irrigation. Yet the country's rural economy still faces three major interrelated problems: low levels of productivity, degradation of land and water resources, and increasing water scarcity.

Only 75% of crop water requirements are currently being met using irrigation. So, there is an urgent need to increase the supply of irrigation water and improve overall water-use efficiency—including delivery efficiency of canal system which is only 35-40% at present. Inequities in water distribution within systems also need to be addressed, as farms in tail reaches often receive less water per hectare than those in head and middle reaches. Other problems concerning irrigation systems include centralized bureaucracies and little accountability on the part of officials, and poor transparency, lack of information-sharing, inadequate maintenance of infrastructure, and insufficient implementation of operational rules.

To address these problems, the government has undertaken three sets of land reforms since the 1950s. In these, large landowners with more than a certain threshold of land lost some to the government. This was then redistributed to smallholders and tenant farmers. But, these reforms were largely ineffective.

New dams, canals and water-storage systems were also planned, and a new National Water Resources Policy drafted in 2002. Many national poverty-

alleviation initiatives were also begun in 2001—but, their impact and effectiveness remain to be seen. However, a program of water reforms was begun in the late 1990s, the impacts of which can be assessed. This focused on improving institutions and overall governance in the water sector.

In the irrigation sector, these reforms aimed to decentralize irrigation management, improve farmers' participation in management, and develop the physical, financial and environmental sustainability of irrigation systems. At the provincial level, therefore, systems are overseen by Provincial Irrigation and Drainage Authorities (PIDAs)—financially autonomous bodies that formulate policy and enforce laws. At the canal-system level, a three-tier irrigation management structure has been established:

- *Area Water Boards* (AWBs)—one per canal command (each covering 0.4 million hectares on average). These have similar functions to utility companies, and consist of (among others) representatives of the PIDA, the Agriculture Department, and farm-household organizations. A pro-poor legal requirement is that representatives from households in both head and tail reaches, and those with large and small landholdings, are included.

- *Farmer organizations* (FOs)—one per distributary. These receive water from the AWBs, and distribute it to farmers. They operate and maintain distributary canals, and assess and collect irrigation charges—60% of which are passed on to AWBs for upstream operation and maintenance (O&M).

- *Water Users' Associations* (WUAs)—one per outlet. These represent farm households sharing water below each outlet along a watercourse.

So far, some 150 FOs have been established. But in Punjab, management has only officially been transferred from a PIDA to an FO in one distributary

Box 1. Study locations and characteristics.

System studied	Overarching system	Irrigation-watersupply	Main crop rotation	Annual rainfall (mm)
9-R	Upper Jehlum Canal	P	Rice-wheat	644
10-R	Upper Jehlum Canal	P	Rice-wheat	644
13-R	Upper Jehlum Canal	NP	Rice-wheat	644
14-R	Upper Jehlum Canal	NP	Rice-wheat	644
Phalia	Gujrat	NP	Mixed-wheat	644
Kakowal	Gujrat	P	Mixed-wheat	644
Lalian	Lower Jehlum Canal	P	Mixed-wheat	413
Khadir	Lower Jehlum Canal	P	Mixed-wheat	413
Khikhi	Lower Chenab Canal	P	Mixed-wheat	372
Hakra-4R	Hakra	P	Cotton-wheat	196

*P = Perennial, i.e. , all year round; NP = Non-Perennial: part of the year.

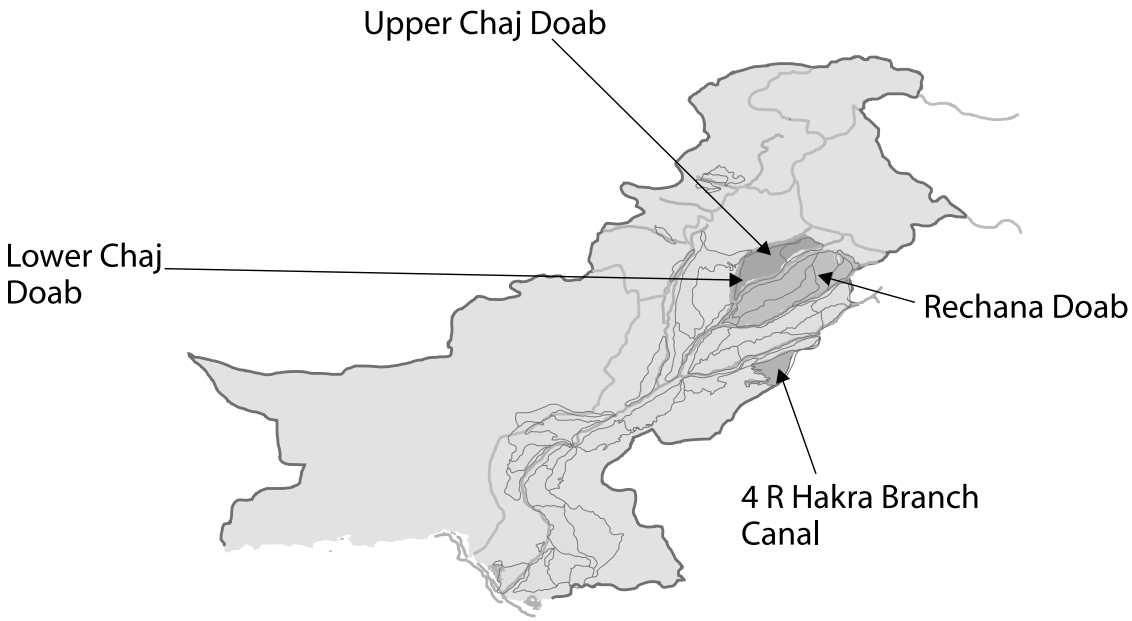
Notes:
Size of irrigation systems: 2,870 to 47,430 hectares.
Average landholding per household: 2.49 to 6.54 hectares.
Contribution of income from crops to total household income: 16% to 55%.

All systems are characterized as 'water-short', and surface water and groundwater are used in combination (either together or in rotation).

(4R) of one system (Hakra), through an Irrigation Management Transfer (IMT) Agreement.

This system was included in IWMI's in-depth study of 10 irrigation systems in the upper Indus basin in Punjab (see Box 1 and Figure 1). The study assessed irrigation system performance, poverty, and relevant institutions, and included interviews with 1,224 households in 2001-2002. All systems other than Hakra-4R are government-managed. Two poverty lines were used for rural Pakistan: (1) the national poverty line of Rs[1] 730/capita/month (equivalent to US$1.46/day); and (2) a line of Rs 530/capita/month (equivalent to US$1.06/day), which is closer to the internationally used poverty line of US$1/day and allows comparisons to be made with other countries.

Figure 1. Location of irrigation systems studied in Punjab, Pakistan: Chaj Doab area (9-R, 10-R, 13-R, 14-R, Phalia, Kakowal, Lalian and Khadir); Rechna Doab area (Khikhi) and Hakra area (Hakra-4R).



Key Study Findings and Outcomes

Poverty, Agriculture and Irrigation

In the study areas, land is very inequitably distributed, as 25% of sample households own 60% of the available land. The Gini coefficient for landholdings (where a value of 0 indicates that all households have equal areas of land, and 1 indicates that one household owns all the land) was therefore high: 0.51 on average, with a range of 0.31 to 0.56. Water is also distributed inequitably, because households are allocated water according to the size of their landholdings. So, large landholders benefit most from irrigation water and are less likely to be poor than households with small landholdings (Figure 2).

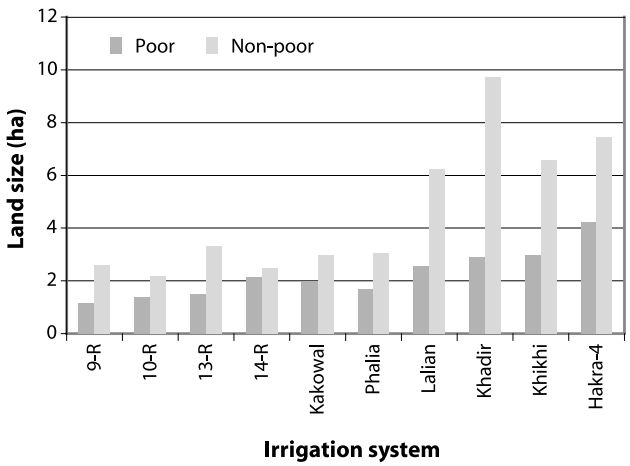


Figure 2. Average landholdings of poor and non-poor households (hectares). Poor households have much less land (between 1.16 and 4.21 hectares) than non-poor households (2.20-7.44 hectares).

[1] 1 US$ = 62.69 rupees

The net values of the crops produced in the irrigation systems were generally low and varied greatly—from US$62 to US$245/hectare. But, they were always higher than the US$35/hectare found in rainfed areas. So, the net benefits of irrigation ranged from around US$26 to US$210 (Figure 3). In general, productivity and the benefits of irrigation were low in systems where land and water distribution is inequitable. So, in these systems poverty was higher.

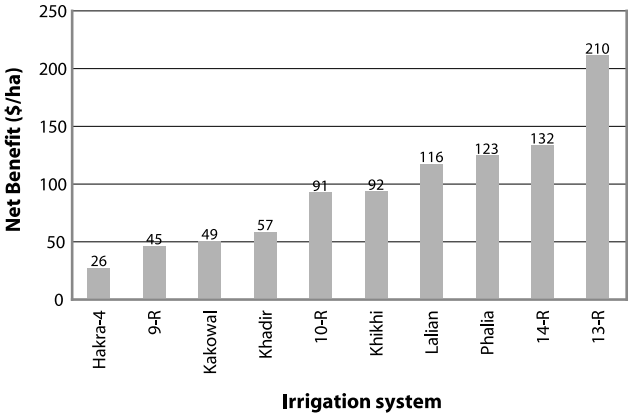


Figure 3. Net benefits of irrigated farming over rainfed farming, in terms of net values of crops produced (US$/hectare). Differences among systems are due to differences in cropping patterns, access to water, and use of other production inputs.

In the systems studied, the incidence of income poverty (the percentage of people below the national poverty line) was 59% on average, varying between 40% and 77% (Figure 4). Within systems, there was a lower incidence of poverty in the middle reaches (where land quality, crop productivity and access to water are better) than in head and tail reaches. Poverty was high among households with large families, a large number of dependants, and no land for cultivation, or only small landholdings (generally less than 2 hectares). Poverty was also high among those located in areas with lower agricultural productivity, few opportunities in the non-farm sector, and poor access to good-quality canal water or groundwater.

Poverty incidence and severity (the degree to which incomes fall below the poverty line) were particularly high among landless households, whose members work as unskilled laborers in agriculture and other sectors. These households—which account for between 21% and 51% of households sampled—had few assets and significantly lower incomes and expenditures (around one-third of those of non-poor households).

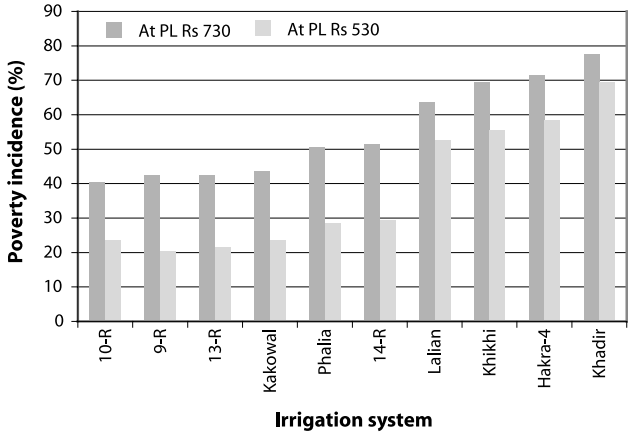


Figure 4. Poverty incidence among systems: percentage of people falling below each of two poverty lines (equivalent to US$1.46 and US$1.06/person/day).

Irrigation System Performance

A key indicator of poor irrigation system performance in the systems considered was low agricultural productivity, caused by inadequate water supplies and poor agronomic/farm-management practices (Box 2). Addressing these problems would reduce poverty significantly. Crop diversification is a key way forward, as it enhances the benefits of irrigation and increases farm incomes. Crop and income diversification were also found to reduce the incidence and severity of poverty. Study results also suggest that small-scale cultivation and resource-

Box 2. Poor agronomic/farm-management practices identified

- Little use of new and improved crop varieties
- Lack of up-to-date knowledge on the quantities and timing of the application of inputs (particularly irrigation water)
- Lack of up-to-date knowledge on new techniques, necessary crop-protection measures, prices, and markets
- Lack of credit, especially in the case of small farmers, to buy inputs (e.g., seeds, fertilizers, pesticides)
- Poor access to key inputs and services available from the government agencies—especially in the case of poor men and women.

conservation technologies—such as bed-and-furrow cultivation, zero-tillage technology, and precision land leveling—increase crop yields by 15-20%, lead to water savings of 20-30%, and benefit farmers by reducing production costs and increasing returns to farming.

Overall, the study identified poor service delivery and low irrigation charges (leading to low spending on O&M) as factors underlying poor irrigation performance.

Irrigation Charges and Costs

In Pakistan, the state/provincial government sets the level and structure of irrigation charges. At the farm level, charges are not based on the amount of water a farmer receives. Instead, they are based on the area cropped, crop type, crop condition, and cropping season (dry/wet). In each season, irrigation/revenue department officials assess the charges due per field. Even in the transferred system (Hakra-4R), charges are set by the government. And, though the charge due is assessed by WUAs, government officials often have a hand in this. In all systems except Hakra-4R, charges are paid to the government, and there is no direct link between funds collected and funds spent on O&M. Annual irrigation charges are low: Rs 274/ha to Rs 635/ha (US$4.4/ha to US$10.1/ha), which is equivalent to 1.7% to 3.9% of the gross value of crops produced per hectare. The charge-collection rate in the studied systems is fairly high (80-99%). On overall basis, collection rate in Punjab as a whole is around 60%.

The charging system is not pro-poor. Per hectare, poor small-scale farmers pay more for irrigation per year than large-scale and non-poor farmers. Because the charge is based on cropping intensity, which is generally higher on smaller farms, they pay more in canal-water charges than larger farmers. Plus, because they are often not allocated enough canal water to crop their land intensively, they also use (per hectare) more groundwater—which is nine times more expensive than canal water.

So, overall, cropping-intensity-based irrigation charging benefits large landholders more than small landholders and the poor. Researchers therefore analyzed the impacts on the poor of three charging-structure policy options (Box 3). They concluded that small and poor landholders would benefit significantly from (1) a flat rate per unit of land based on land size (independent of crop area, crop type and cropping intensities), applied uniformly across all farm-size categories, or (2) the application of different rates to different farm-size categories.

Such policy changes do not involve any major implementation costs. Plus, they would increase the funds available for O&M, so increasing water-supply efficiency, and thus productivity.

Box 3. Irrigation charging: policy options

- Option 1: Current charging policy—based on cropped areas and cropping intensities.
- Option 2: Flat-rate policy—flat rate per unit of irrigated land based on land size, independent of crop type and cropping intensities, i.e., current average irrigation charge applied uniformly across all farm-size categories.
- Option 3: Differential-rate policy—a lower irrigation charge is levied on the first two hectares of each landholding regardless of size. For landholdings greater than two hectares, the per-hectare irrigation charge then increases by Rs 50/hectare as farms increase in size.

Option 3 is better than Options 1 and 2 in terms of revenue and equity (Table 1). Option 2 is relatively equitable, and Option 3 is pro-poor, as the per-hectare irrigation charge paid by the poor would be less than that paid by the non-poor, and significantly lower than the charges under Options 1 and 2. Option 3 is a win-win scenario in terms of cost recovery and benefits to the poor.

Table 1. Financial impacts of Options 2 and 3, compared with Option 1, for Punjab Province

	Option 2: Flat rate	Option 3: Differential rate
Gains by small farmers resulting from reduced costs (million rupees/year)	74.45	346.88
Increased cost to large farmers (million rupees/year)	326.77	529.76
Increase in revenue	5.3%	21.8%

Note: Recently, the Punjab Government has adopted flat rate charge policy with lower rate (upto 50%) for tail-end farmers.

Impacts of Irrigation Reform: Hakra-4R

After the handover of the system's management to farmers in May 2000, irrigation charges in Hakra-4R were increased by 14% (to Rs 199/hectare). This has provided around Rs 1 million in revenues—which means more funds for O&M. The management and condition of irrigation infrastructure have been improved (through desilting, bank strengthening and other repairs), as have fee-collection rates, service delivery, and overall system performance (crop productivity, equity in water distribution, and access to water by tail-end users). In Hakra-4R, the head-tail equity ratio was around 1—the most equitable water distribution found in the study. In other systems, the ratio ranged from 1.23 to 2.50, indicating significant inequity in water distribution. Because poverty incidence is greater at the tail ends of Hakra-4R, increasing the water supply to those areas has benefited poor farmers.

Overall, these improvements meant that 1,501 extra hectares could be cropped—a 6% gain. Other benefits seen included less water theft, better assessment of irrigation charges, more information-sharing among farmers, and fewer cases of litigation related to, for example, 'rent-seeking behavior' by irrigation officials. But, concerns were raised about the amount of control that influential people and larger landholders might wield over water resources, due to the huge inequities in land distribution and the resulting highly inequitable rural power structures - not only in Hakra-4R but also in all other systems studied in Punjab.

Recommendations and Interventions

Create Assets for Poor Men and Women

Pro-poor governance should be encouraged and safety nets and physical, social and economic assets created for the poor. Redistribution of land to landless rural household is a key first step. Currently, 0.29 million hectares of land taken from large landowners during land reforms, and 0.89 million hectares of largely undeveloped state land are available. The government should also introduce incentive- and market-based land reforms—even if this means buying land for distribution to the landless poor (who constitute the bulk of the rural poor) and to poor and marginal male and female farmers. All holdings should be large enough to support a family. The effective creation of land assets for the poor, would improve the distribution of benefits from water-sector investments and significantly reduce rural poverty.

Improve Performance of, and Service Delivery in Irrigation Systems

The performance of Pakistan's irrigation systems could be improved significantly, greatly reducing poverty. Institutional reforms such as the Hakra-4R IMT model—which benefit the poor by improving water distribution and crop productivity—should be replicated in other canal commands, with due considerations to the differences in underlying socio-economic and resource distribution structures across communities. However, strong regulatory backup and monitoring is needed, to ensure that the poor receive the expected benefits, and that poor small-scale farmers and those at the tail ends are represented in WUAs and FOs. Although management organizations should operate as commercial utility companies, they should also meet performance-improvement and pro-poor targets. System handovers should be accompanied by improvements in irrigation infrastructure and higher irrigation-service charges. Irrigation reforms should be linked to broader agricultural improvement and poverty reduction strategies.

Make Irrigation Systems Financially Self-Sufficient

Systems should be financed through the full recovery of O&M costs. The present charging policy harms the poor, so the level and structure of charges should be corrected, with charges being related to service delivery. The proposed differential-rate strategy could be adopted to benefit the poorest.

Integrate Management of Surface Water and Groundwater

Access to canal water and groundwater quality both vary greatly among canal commands. Poor farmers often rely more on groundwater than larger farmers do. Since the study found that conjunctive management of surface water and groundwater boosts productivity and is pro-poor, the two resources need to be managed jointly, especially in poor areas.

Improve the Poor's Access to Inputs and Services for Increasing Agricultural Productivity

As crop productivity (per unit of water and land) is low, better access to other production inputs (fertilizer, improved crop varieties, etc.), and better marketing of outputs is needed. One solution may be the integrated, low-cost delivery of the major inputs and services. This could be achieved by involving the private sector in service delievery (with the public sector playing an important role as an enabler, facilitator and regulator). However, more research is needed on this intervention.

Enhance Benefits of Irrigation to the Poor

Crop diversification and the use of resource-conserving technologies were found to have significant impacts on farm incomes of smallholders. So, the benefits of available irrigation water resources could be enhanced by diversifying into high-value crops (including non-conventional crops). The effective dissemination of existing resource-conserving technologies and the development of new technologies also offer ways forward.

Target New Investments to the Poor

In many areas, investments are needed to further develop, improve and rehabilitate surface-water supply systems. New investment should target poor men and women, both geographically and socio-economically.

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Full references for the information presented in this briefing are contained in the above reports.

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