

# Pro-poor Interventions in Irrigated Agriculture

## Issues, Options and Proposed Actions

### Bangladesh



Despite reasonable economic growth, about half of Bangladesh's population still lives in poverty and about a third in extreme poverty. The problem is worse in rural areas, where huge inequities in land and water distribution hit the poorest hardest. Agricultural productivity is low and irrigation systems are not performing as well as they should be. Irrigation management reforms began in 1995 to address this. But, the reforms were more successful on paper than in reality. On the ground, few groups are actually working properly.

# Pro-poor Interventions in Irrigated Agriculture in Bangladesh: Issues, Options and Proposed Actions

## 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 Bangladesh. It is one of a series produced by the project 'Pro-poor Intervention Strategies in Irrigated Agriculture in Asia', 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 were 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

Bangladesh's economy has improved significantly in recent years. The country's gross domestic product (GDP) increased by 64% between 1991 and 2000, helped by a growth rate of 41% in its agricultural sector. But despite these improvements, Bangladesh's people remain among the poorest in South Asia, earning only around US\$350 each on average per year.

Nearly 75% of the country's population depends either directly or indirectly on agriculture, which generates 63% of total national employment and around 25% of national GDP (about 71% of which is derived from crop production). So, this sector's performance strongly affects Bangladesh's malnutrition and poverty levels.

Rice is the major crop (grown on 80% of the country's irrigated area), but wheat is growing in importance. Combined, the yearly production of both crops increased from around 10 million tonnes in the early 1970s to nearly 25 million tonnes by the late 1990s, improving food self-sufficiency and food security nationally. Such growth has helped to reduce the percentage of poor in the country, from 58.8% in 1992 to 49.8% in 2000.

But poverty remains a serious problem in Bangladesh, especially in rural areas where the average poverty level is 53% (as compared with 37% in urban

areas). Typically, poverty levels are higher among the landless—especially those who work as agricultural wage laborers. But, the incidence of extreme poverty is highest among female-headed households.

A large population (currently 135 million), growing at 1.5% per year, poor governance, frequent natural disasters (such as cyclones and floods), and a lack of jobs, services and infrastructure, all contribute to poverty in Bangladesh. Other major problems are the country's limited resource base and the highly inequitable way in which resources (especially land) are distributed. For example, around 57% of households are either landless or own only marginal amounts of land (up to 0.2 hectares). Even among those classed as landowners, holdings are very unevenly distributed—only 19% of them own 59% of the land currently in use.

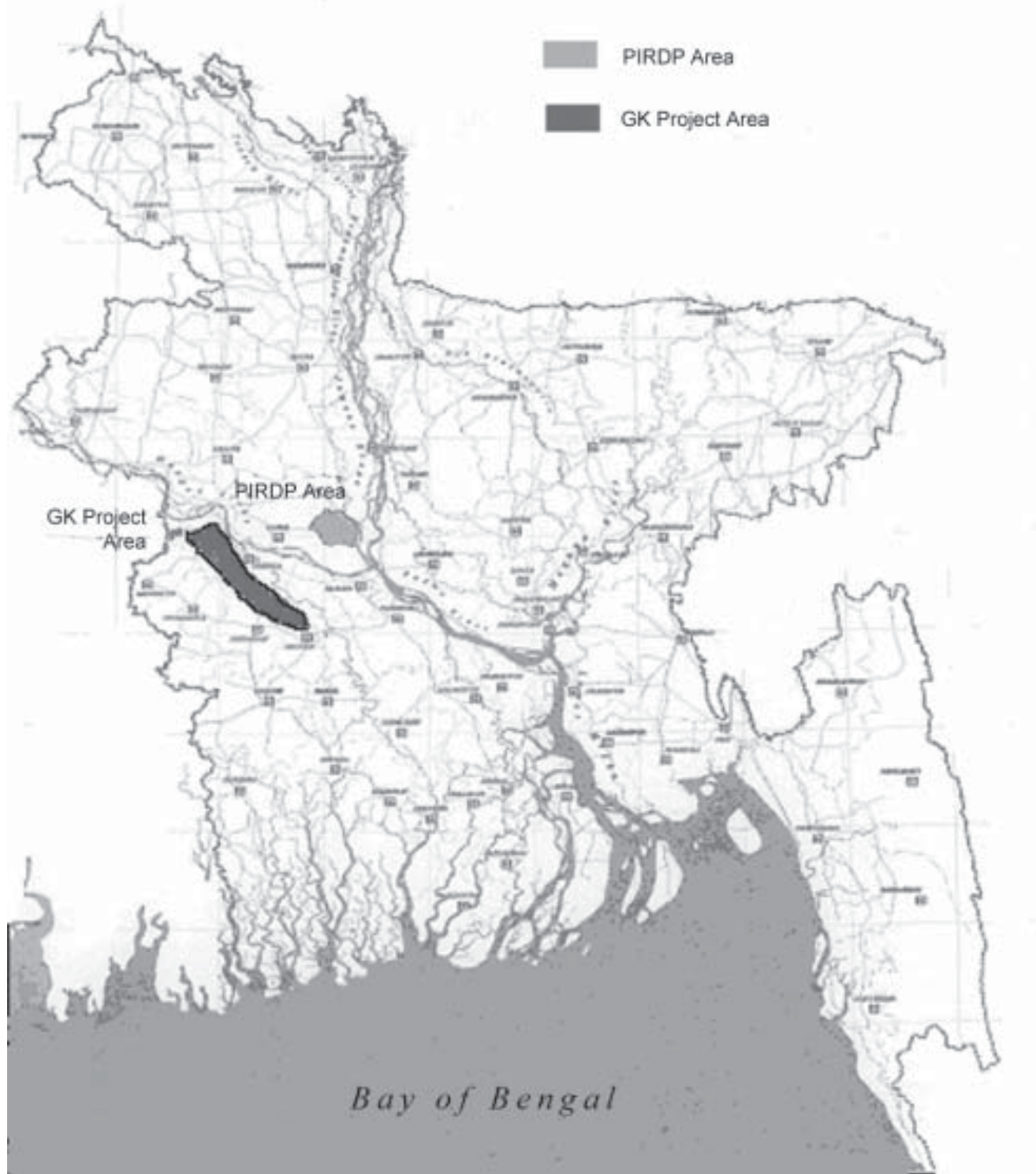
Improvements in Bangladesh's irrigation sector could be used to further improve agricultural production and reduce poverty. For example, only 4 million hectares of the 7.58 million available for irrigation were actually irrigated between 1999 and 2002. So, irrigation could be expanded significantly—if surface water and groundwater resources are properly exploited.

To plan and implement water resource use, Bangladesh's government has established a number of organizations, from the national through to the local level. But, these organizations remain inefficient: they

lack coordination and their functions tend to overlap. Moreover, these efforts have tended to concentrate on reorganization at the national level. Not enough attention has been paid to organizational development at the lower levels.

To address this, participatory irrigation management (PIM) was begun in 1995, with the introduction of a three-tier management structure for irrigation systems. This involved creating tertiary-level Water Management Groups (WMGs; each consisting of

Figure 1. Location of the G-K and Pabna irrigation projects in Bangladesh.



nine members—three from each of three farm-size categories: ‘large’, ‘medium’ and ‘small’); secondary-level Water Management Associations (WMAs; consisting of 10-15 WMGs); and a Water Management Federation (WMF) at the highest level of a system.

But, progress in creating and developing these user groups has been slow, and the irrigation sector continues to be managed at all levels by public-sector agencies. The 1999 National Water Policy (NWP) may change this, as it has important pro-poor and participatory dimensions; but, its effectiveness remains to be seen.

To assess irrigation system performance, poverty, and relevant institutions, and to identify concrete pro-poor interventions, IWMI and the Dhaka-based Bangladesh Unnayan Parishad (BUP) conducted a comprehensive study of two of the country’s major irrigation systems: the Ganges-Kobadak (G-K) irrigation system, and the Pabna Irrigation and Rural Development Project (see Box 1 and Figure 1). Participatory rural appraisals (PRAs) and interviews with key stakeholders were carried out, and 900 households were interviewed in the two systems and adjoining rainfed areas in 2001-2002. To measure poverty, the study used the national income poverty line (Tk<sup>1</sup> 833 per person per month, equivalent to US\$1.37/day in purchasing power parity terms).

<sup>1</sup>US\$1.00 = 59.54 taka.

### Main features of the two irrigation systems studied.

**Ganges-Kobadak (G-K) Irrigation Project.** Located on the floodplain of the Ganges river (southwestern Bangladesh), the project was designed in the mid-1950s to supplement rainfall for rice production and to protect crops from damage caused by the flooding of the Ganges. Average rice yields are 3.2-4.0 tonnes/hectare for high-yielding varieties (HYVs) and around 2.5 tonnes/hectare for local varieties. Around 70% of the area’s population depend on agriculture.

**Pabna Irrigation and Rural Development Project (PIRDP).** Located on the floodplain of the Brahmaputra and Hurasagar rivers (west-central Bangladesh), this project aimed to provide flood control, drainage, and irrigation facilities. The study was conducted in the Phase-I area, which was completed in 1992. The average annual incomes of small-, medium- and large-scale farmers are US\$487, US\$846 and US\$1,347, respectively.

Both project areas are now almost flood-free due to the construction of embankments. In both areas, the November-March period is mainly dry.

**Table 1. Characteristics of project areas.**

	G-K	Pabna
Total project area (hectares)	197,500	186,000
Area irrigated (hectares)	142,000	145,000
Average annual rainfall (mm)	1,500	1,900
Percentage of rain falling between mid-June and mid-October	70	77
Main crop grown (% of cropped area)	Rice (70%)	Rice (64%)
Other crops	Oil seeds, tobacco, jute, sugarcane, onion, wheat	Pulses, potato, vegetables, oil seeds, jute, sugarcane, onion, wheat
Average landholding (hectares)	0.93	0.92

## Key Study Findings and Outcomes

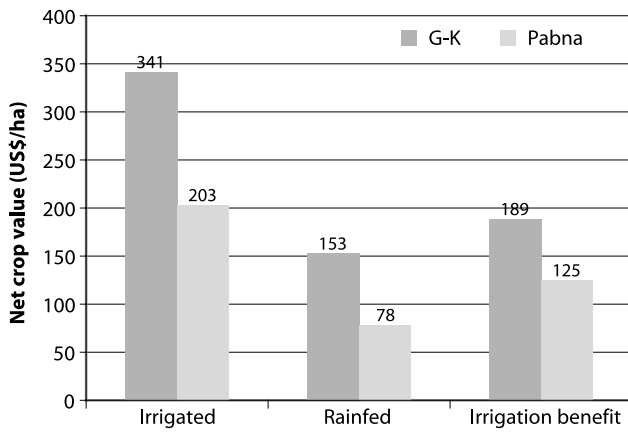
### Agriculture, Poverty and Irrigation

In both systems studied, land is inequitably distributed. The problem is worse in the G-K system, where only 2% of landowning households own 43% of the available land, and 16% of households are landless. In the Pabna system, 6% of landowning households own 25% of the available land and 14% of households are landless. In both systems, the majority of households (71% in G-K, and 78% in Pabna) own 1 hectare of land or less.

In comparison with rainfed areas, irrigation has significantly increased both cereal crop production (by 2.5-3.0 tonnes per hectare) and net returns to farming in all reaches of both systems (from ‘head’ to ‘tail’). This has helped increase farm incomes. For example, the net values of crops produced per hectare are US\$341 in the G-K system and US\$203 in the Pabna system—more than double the values in rainfed areas. Indeed, the net benefits of irrigation are, on average, US\$189/hectare and US\$125/hectare in the G-K and Pabna systems, respectively (Figure 2).

These irrigation benefits mainly result from farmers being able to crop their land more intensively (because of access to irrigation water), and the greater use of production inputs and modern technologies—such as high-yielding varieties (HYVs)—on irrigated land.

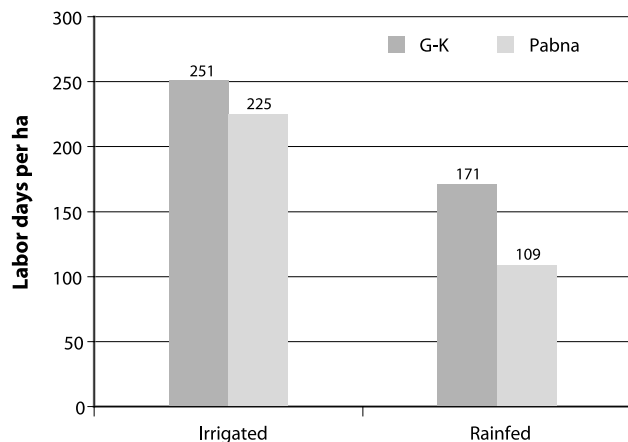




**Figure 2.** Net value of crops produced (US\$/hectare) in irrigated and rainfed farming in two irrigation systems (G-K and Pabna), and 'net irrigation benefit'—the difference between net crop values in irrigated and rainfed areas (US\$/hectare).

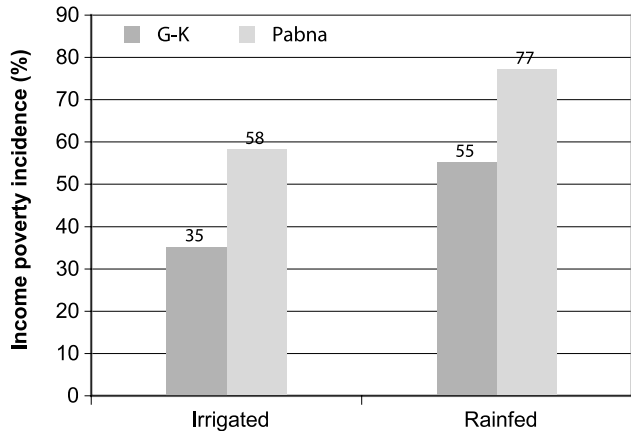
Importantly, the benefits of irrigation are strongly pro-poor. In both G-K and Pabna, farmers with very small landholdings (less than 1 hectare) obtained higher yields per hectare than larger landholders. This is because the land-poor farmers use the available water more efficiently, grow HYVs of rice on a greater proportion of their land, and irrigate more intensively than farmers with more land.

What's more, irrigation has also benefited poor, landless men and women—from both irrigated and rainfed areas—by providing jobs. In both systems, modern, irrigated rice cultivation has increased employment by 80 to 116 labor days/year per hectare (Figure 3). This income-earning opportunity has helped many land-poor keep what land they have, preventing them joining the ranks of the landless.



**Figure 3.** Employment in irrigated and rainfed farming (days of labor per hectare per year) in two irrigation systems (G-K and Pabna). Irrigation generates more opportunities for wage labor for the poor and landless.

Though the incidence of poverty is relatively high in the irrigated systems (58% in the G-K system, and 35% in the Pabna system), it is much higher in the surrounding rainfed areas (Figure 4). In both systems, poverty is high in households that have little or no land, high numbers of dependants, a low level of education, and whose agricultural productivity is low.



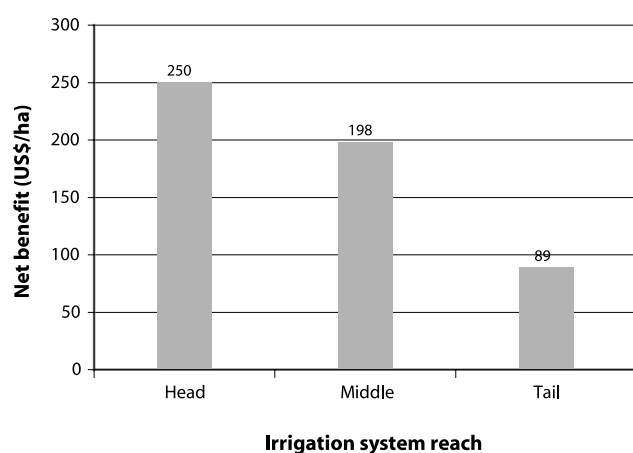
**Figure 4.** Percentage of people having incomes below the national poverty line (Tk 833/month, equivalent to US\$1.37/day in purchasing power parity terms) in two irrigation systems (G-K and Pabna). Compared with rainfed farming, irrigation has reduced poverty by around 20%.

### Causes of poor irrigation system performance

- Inadequate power supplies for pumping river water
- Inadequate numbers of tertiary channels
- High operational water losses from the canal system, especially through seepage
- Poor O&M
- Poor irrigation intensity
- Inadequate extension services for transferring new production technologies to farmers
- Low adoption of high-yielding rice varieties
- Little crop diversification
- Little or no farmer access to micro-credit
- Inadequate and poor-quality supplies of farm inputs
- A continuing bureaucratic top-down approach to irrigation management
- Little community participation in the design, implementation, and management of irrigation projects
- The ineffectiveness of WMGs and WMAs in most areas

In reality, the performance of both irrigation systems is less than satisfactory. Irrigation intensity (the ratio of net irrigated area to the designed command areas) is low, varying widely across seasons and reaches of the systems. Crop yields per hectare are relatively low as well, mainly because farmers do not use enough productivity-enhancing inputs. Rice yields per cubic meter of irrigation water are also low: 0.12-0.48 kg in the G-K system, and 0.006-0.163 kg in the Pabna system.

In addition, performance of the tail ends of systems is generally poor, as these areas often do not get enough irrigation water because of inequalities in water distribution and inefficient management. So, overall, households in the head and middle reaches have benefited more from irrigation (Figure 5).



**Figure 5.** Net benefits of irrigation over rainfed farming (in terms of net values of crops produced per hectare) in different reaches of irrigation systems (US\$/hectare). Tail ends receive least water, so crop yields are lowest—and irrigation benefits are less than one-third of those at the head ends.

The study identified a number of problems limiting the performance of Bangladesh's irrigation systems (Box 2), as well as ways to improve performance—especially by raising crop productivity, and thus farmers' incomes. There is ample scope, for example, for expanding irrigated areas and increasing irrigation intensities. In both projects, irrigation coverage could be expanded in all three cropping seasons (dry, pre-monsoon and monsoon), by improving water-conveyance efficiencies in the system.

Other priorities are promoting the use of precision-irrigation technologies, and providing on-farm water-management training to water user groups and associations. HYVs could be planted more widely. And—in both project areas—multiple cropping, intercropping, and crop diversification should be

promoted. High-value winter vegetables including potato are already being cultivated in some areas—these crops could be expanded during the dry and pre-monsoon seasons, using partial irrigation.

## Reforms and Institutions

In many areas, the groups set up under the 1995 PIM reforms have not been properly formed. This was probably due to the process used, which involved targets and strict deadlines but little capacity-building work on the ground. In the Pabna system, for example, only two of the 365 WMGs formed have been registered with the government. WMGs and WMAs have improved maintenance and water distribution in the G-K system, but only in some areas.

In neither system studied do these groups assess or collect irrigation charges, or dictate how the revenues are spent. These functions are still being performed by the Bangladesh Water Development Board (BWDB), a government agency. Because user groups have not yet taken on this role, as originally envisioned, collection rates remain very low.

During PRAs and group discussions, user groups stated that they are willing and able to take responsibility for managing the systems, provided they are handed over in good working order, and that they receive legal and technical support, and are allowed to assess and collect charges. Because of inequities in land distribution, users feared that poorly implemented reforms might lead to already-powerful landholders gaining control over water resources.

Reforms also aimed to help the poor and landless. Three types of group have been formed to provide landless men and women with employment and income-generating opportunities:

- Labor- (or landless-) contracting societies (LCSs)
- Embankment maintenance groups (EMGs)
- Channel maintenance groups (CMGs).

These groups ensure that the poorest receive fair wages for necessary infrastructure work, such as construction (in the case of the LCSs) or maintenance (in the case of the EMGs and the CMGs). They are required to ensure that women, and female-headed households (one of the poorest groups in society), receive an equitable share of the work to be undertaken.

CMGs are in place in the Pabna system and EMGs are operating in the G-K system. In both systems, most of the members of both EMGs and CMGs are vulnerable women. In addition to earning a wage, women benefit from being able to use the slopes of the canals and the embankments to grow vegetables, thereby earning extra incomes.

### **Irrigation Service Charges**

Water charges are not based on the volume of water used, but on (1) the area irrigated (irrespective of the size of the farm), and (2) the type of crop grown (depending upon its water requirements). Charges average around Tk 500/acre in G-K and Tk 540/acre in Pabna (US\$20.74/ha, and US\$22.39/ha, respectively). But, collection rates are poor in both the systems: 9% of the target sum in Pabna, and 5-15% in G-K.

## **Recommendations and Interventions**

### ***Increase the Area Irrigated***

Further investment is needed to ensure that the whole potential command area of systems is irrigated. *Targeting new investments at poor communities* is a priority.

### ***Involve Beneficiaries in Irrigation Management***

Public-sector agencies alone have not significantly improved agricultural performance. *PIM* or irrigation management transfer (IMT) activities should be used to ensure WMGs and WMAs are formed, function effectively, and participate fully in O&M. The BWDB should also operate more transparently. Regular consultation with farmers and the WMGs and WMAs representing them should be mandatory.

### **Distribute Water Equitably within each System**

Action is needed to ensure that water is available equally across all reaches of the system (head, middle and tail), as well as to all socioeconomic groups (e.g., small and marginal farmers). The *three-tier reform model* should be implemented effectively, as it emphasizes participatory approaches and represents the poor and those at the disadvantaged locations.



### **Reduce Water Losses**

Surface water is becoming increasingly scarce. Water losses from canals need to be cut through proper maintenance, user involvement, and *canal lining in selected areas*, through further targeted investments.

### ***Promote Crop and Enterprise Diversification***

Farmers should be helped to move away from monocropping rice towards growing high-value crops. They should be helped to start farm enterprises appropriate to their agronomic and agro-ecological settings. Efforts should be linked to the new National Water Policy, the new National Water Management Plan, and the new Agricultural Policy.

### ***Build Effective Partnerships***

To improve agricultural yields per unit of labor, irrigation water and land, integrated application of irrigation, seed and fertilizer technologies is needed. This should be achieved by *building effective partnerships* between BWDB and other government agencies on the one hand and WMGs/WMAs on the other.

### ***Adopt an Integrated Approach to Service Delivery***

An *integrated approach* should be adopted to reduce poverty and increase production. This would view irrigation as one critical production input, combining it with the provision of credit, agricultural inputs, marketing services and information in an integrated framework.

### **Implement the Three-tier Reform Structure Comprehensively**

The existing WMGs and WMAs are not yet fully active in all areas, even in the long-standing G-K project. In different parts of Pabna, they are still in the early stages of operation or formation. Steps need to be taken to make these organizations more effective. So, the management of all canals at the tertiary level and below should be handed over to WMGs, avoiding piecemeal implementation of the reform.

### **Establish Equitable Irrigation Rights and Obligations**

No regulations exist for dealing with non-payment of irrigation charges. Also, the National Water Policy does not specifically address irrigation rights and obligations. These should be established at both policy and operational levels, and WMGs and WMAs should ensure they are properly observed in the field—to ensure equity in water distribution and efficiency in water use.

### **Improve Irrigation-charge Collection**

Throughout Bangladesh, irrigation-charge collection rates are poor. Because the sums collected do not cover even a small part of the cost of O&M, less is spent on system maintenance than is required. So, *assessment and collection of irrigation charges, and revenue-spending responsibilities should be handed over to the water-user organizations.*

### **Increase Employment Opportunities for Marginal Farmers and the Landless**

IMT agreements should include provisions for giving maintenance and water-distribution work to the land-poor and landless, along the lines of LCS, CMG and EMG groups. This should be one of the important pro-poor dimensions of irrigation reforms.

### **Promote Off-farm Rural Activities for the Land-poor and Landless**

As agricultural incomes increase, because of improved irrigation management and agricultural practices, the scope for new agro-support activities (e.g., supply of fertilizer, pesticide, farm implements, etc.) and agro-processing

opportunities (e.g., vegetable and fruit processing) will expand. The land-poor and landless could start up small enterprises in these areas, if they are given appropriate advice, and if credit, technologies and other needed services are made available.

### **Redistribute Land**

In the long term, greater emphasis should be placed on creating permanent assets for the poor, by redistributing land to the marginal farmers and the landless through effective (administrative, or incentive- and market-based) land reforms. This would help to alleviate poverty, by increasing productivity and improving the equitable distribution of the benefits brought by new investments in the irrigation sector.

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

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