Pro-poor Intervention Strategies in Irrigated Agriculture in Asia

Poverty in Irrigated Agriculture: Realities, Issues, and Options with Guidelines

INDIA, PAKISTAN, BANGLADESH, CHINA, INDONESIA, VIETNAM

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Acknowledgements

This is the final summary report for the ADB-financed research project on “Pro-poor intervention strategies in irrigated agriculture in Asia.” The project was implemented by the International Water Management Institute (IWMI) in collaboration with key national partners in six countries: India, Pakistan, Bangladesh, China, Indonesia and Vietnam. Much of the material summarized in this report is based the draft final country reports prepared by the country teams in collaboration with IWMI. Cooperation and dedication of the country study teams for successful implementation of the project are highly appreciated. Special thanks are due to Dr. Q.K. Ahmed and Mr. K. Rahman (BUP-Bangladesh), Drs. Jikun Huang and Jinxia Wang (CCAP-China); Drs. Chris Scott and M. V. K. Sivamohan (IWMI-India); Drs. Sigit Arif and Mochammad Maksum (CRRD-UGM, Indonesia); Drs. Waqar Jehangir and Mohammad Ashfaq (IWMI-Pakistan); and Drs. Eric Biltonen and Doan Doan Tuan (CIWSR, Vietnam). Thanks are also due to other study team members in each country. Financial support from the ADB for the project is gratefully acknowledged.Valuable comments and suggestions during the early phase of the project from the ADB, particularly from Messrs. Wouter Lincklean Arriens, Kenichi Yokoyama and Toru Shibuchi are highly appreciated.

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Executive Summary

The "Pro-poor intervention strategies in irrigated agriculture in Asia" is the ADB- financed study under its 'RETA No. 5945–Fifth Agriculture and Natural Resources Research at CGIAR Centers dated 8 February 2001' implemented by the International Water Management Institute (IWMI) in collaboration with key national partners in six Developing Member Countries (DMCs) of the ADB: India, Pakistan, Bangladesh, China, Indonesia and Vietnam. The overall goal of the study is to promote and catalyze equitable economic growth in rural areas through pro-poor interventions in irrigated agriculture in the participating countries. The main objective is to determine realistic options for increasing returns to poor farmers in the low-productivity irrigated areas within the context of improving the overall performance and sustainability of the established irrigation schemes.

The study participating countries are among the top few countries where substantial investments have been made in the development of large- and medium-scale canal irrigation systems, and where irrigated agriculture provides livelihoods to hundreds of millions of rural people. These countries together account for over 51 percent of global net irrigated area and over 73 percent of net irrigated areas in Asia, with most of this area located in China, India and Pakistan. However, agricultural development and poverty-alleviation performance has varied greatly in these countries over the past three decades. Among these countries, poverty is lowest in China and highest in Bangladesh and Pakistan. China has made remarkable progress in reducing poverty since the late 1970s. From 1978 to 2000, more than 200 million rural poor have been lifted out of poverty, with poverty incidence in 2000 estimated at 3.4 percent in rural areas and less than 2 percent in urban areas, and income poverty continues to decline in the country. Such a large reduction in poverty is generally attributed to broad-based economic reforms, which included the adoption of a production responsibility system, dismantling of the commune system, agricultural product price adjustments and market liberalization, resulting in dramatic rural growth. Likewise, rural infrastructural investments, including investments in irrigation, have significantly contributed to growth and poverty alleviation. The agriculture sector, which showed an impressive performance, was at the forefront of reforms. Vietnam also has an impressive record of combating poverty. The estimates for Vietnam show that the incidence of poverty fell from 58 percent to 37 percent between 1993 and 1998, largely attributed to recent *doi moi* reforms. In 1997, the economies of almost all Southeast Asian countries, including Indonesia and Vietnam were adversely affected by the Asian-financial crises. In Indonesia, for example, poverty increased from 11 percent in 1996 to 20 percent in 1999. However, since then, poverty appears to have declined considerably, though it is still substantially higher than in the pre-crisis period. These countries are now getting back on track.

Bangladesh has made good progress over the past decade despite the worst of floods. However, over one-third of the country's population continues to suffer in poverty, which remains one of the serious socioeconomic problems in the country. While estimates vary, around one-third of population in India continues to live under poverty. The large population size of over one billion, along with historically high inequalities in resource distribution, continuing deprivations of education and basic health, gender issues, class and caste inequities are some of the underlying factors. In Pakistan, the poverty situation has worsened over the past decade, and the estimates suggest that more than 12 million people were added to the poor in Pakistan between 1993 and

1999. The rising poverty was the result of poor governance and slow economic growth. The rural economy of the country has been caught up in a vicious circle of problems, rapidly increasing population resulting in decreasing per capita resource base, low literacy levels, continuing high level of inequity in resource distribution, slow growth in both farm and nonfarm sectors, and more importantly, continuing poor governance—all these factors adversely affecting the efforts to reduce poverty. Agricultural economy, which forms the backbone of the broader rural economy of the country is facing problems of increasing water scarcity, degradation of land and water resources, and continuing low levels of agricultural productivity. Effectiveness and overall impacts of poverty alleviation initiatives started in 2001 are yet to be seen.

01 In the above context, the study was carried out in selected representative medium and large-scale established irrigation systems and their peripheries. The study selected 26 irrigation systems with diverse characteristics that, put together, are to a great extent representative of canal irrigation systems in the region. The selected systems vary in terms of size from 813 ha to as large as 508,000 ha, canal water availability and groundwater use, conjunctive use of surface water and groundwater, rainfall from 200 mm to over 1,500 mm, crop productivity, cropping patterns and level of crop diversification from mono cropping to highly diversified cropping patterns, irrigation infrastructural condition and its maintenance, irrigation management patterns (agency management, participatory management, transferred systems), land quality, size of household landholdings and other similar characteristics.

02 The study's main components include: a) assessment of poverty and impacts of irrigation on poverty—*analysis of irrigation-poverty linkages*, b) assessment of irrigation system performance and its linkages with poverty – *diagnosis of causes of existing problems related to irrigation performance and their implications for the poor*, and c) assessment of recent interventions under institutional reforms in irrigation and their implications for the poor—*drawing and synthesizing lessons from interventions and innovations*. The study used both secondary data and field-level primary data and information, and employed both qualitative and rigorous quantitative approaches to analyses. Secondary data were obtained from a variety of sources including government publications, donor reports, and other published and unpublished sources. However, the primary data collected from the field provided a major source of analyses for the study. IWMI, in collaboration with national partners, developed a variety of tools for primary data and information collection, such as field-level focus group discussions, participatory rapid appraisals and a *structured* questionnaire for household-level surveys. For household-level surveys, consistent procedures were adopted for developing a sampling framework and for sample selection across selected systems in the six countries. For each irrigation system, samples were drawn using a multistage stratified, cluster and random sampling methods. The total survey sample size was 5,408 households in the 26 selected systems. The survey covered all cropping seasons during the 2001-2002 agricultural year.

The study defines a pro-poor intervention in irrigated agriculture—policy, institutional, managerial, legal or regulatory, financial, economic, infrastructural or technological—as one which leads to improvements in agricultural productivity; returns to factors of production, such as land, water and labor; returns to farming; employment and wages;

incomes and expenditures and overall livelihoods; and which generates assets and opportunities for the poor to participate in socioeconomic activities for their welfare, and have significant impacts on poverty reduction. Further, an intervention may be regarded as: a) *strongly pro-poor* where share of the poor in positive incremental impacts/benefits of an intervention (such as improvements in the above indicators) is significantly greater than their current share and also greater than the share of the nonpoor; b) *pro-poor* where the share of the poor in positive incremental impacts/benefits of an intervention (such as improvements in the above indicators) is greater than their current share; c) *neutral* where the share of the poor in positive incremental impacts/benefits of an intervention (such as improvements in above indicators) is equal to their current share; d) *anti-poor* where the share of the poor in positive incremental impacts/benefits of an intervention (such as improvements in above indicators) is less than their current share or the share of the poor in negative incremental impacts/disbenefits of an intervention is greater than their current share.

03 The summary and synthesis of the study's primary findings are presented under six specific issues explored in the study: a) inequity and poverty in irrigation systems—magnitude, causes, and patterns; b) impacts of irrigation on poverty alleviation; c) irrigation system performance and poverty linkages; d) irrigation service charging — implications for the poor; e) institutional/management reforms in the irrigation sector—implications for the poor; and f) other aspects such as crop diversification, resource conserving technologies, integrated service provision in agriculture—their implications for enhancing the value of irrigation water and benefits to the poor.

04 Inequity and poverty in irrigation systems—magnitude, causes, and patterns:

a) The average landholding size per household in selected systems varies from 0.25 hectare (Indonesia) to 6.54 hectares (Pakistan). Household landholdings are of much smaller size in selected systems in Indonesia, Vietnam and China than in selected systems in South Asia. While landlessness and high inequity in land distribution are major problems in South Asian countries, excessive scattering of household landholding (an outcome of rather "over-equity" in land distribution carried out under reforms) is a key issue in Chinese and Vietnamese agricultural economies. Overall, inequity in land distribution is highest in Pakistani systems with an average Gini coefficient for land distribution as high as 0.49 and lowest in the Chinese systems.

b) Equity in water distribution is directly proportional to equity in land distribution. Where land distribution is highly equitable (as in Chinese and Vietnamese systems), water distribution also tends to be equitable or often pro-poor as the poor tend to rely more on agricultural activities than the nonpoor. Further, upstream-downstream inequities in water distribution are much higher in South Asian systems compared to those in Southeast Asia and China.

c) Agricultural productivity/ha of land and water in South Asian systems is much lower varying from US$230/ha to US$637/ha (with productivity in India higher than that in Pakistan and Bangladesh) than that in the Southeast Asian systems and also much below

the realizable potential. Also, productivity in these systems is lower on relatively larger-size farms, where land-rich farmers tend to underuse their holdings while the land-poor farmers do not have access to sufficient land, compared to that on smaller-size farms. On the other hand, productivity in Southeast Asian and Chinese systems is fairly high varying from US$665/ha to US$1444/ha, with productivity in China higher than that in Vietnam and Indonesia.

d) Productivity-related benefits of irrigation are lower in systems where land and water distribution is inequitable, average landholdings are of relatively larger size, cropping patterns are least diversified with high-value crops, and overall productivity performance is poor; these factors characterize most of the South Asian systems.

e) Income poverty in irrigation systems varies from 6 to 77 percent, with poverty in South Asian systems much higher than that in Southeast Asian and Chinese systems. In general, poverty is higher in those systems, where land distribution is highly inequitable, productivity and agricultural performance of systems is low and overall benefits of irrigation are low. Income poverty is high among households poor in land, water and education but rich in unskilled labor. Rigorous econometric analysis shows that inequities in land and water distribution, low crop productivity, lack of farm and income diversification opportunities, and large family sizes are principal causes of high poverty in South Asian large-scale canal irrigation systems. Further, simulation results suggest that in South Asian systems, equitable land redistribution and productivity enhancements can have a significant dent on poverty, a 1 percent increase in income from improved crop productivity and associated sources of income would reduce poverty by more than 1 percent or almost 20 percent of income poverty can be reduced by increasing productivity level from US$200/ha to US$1,000/ha. Similarly, a 1 percent increase in equity index for land distribution will reduce poverty by 0.48 percent. These values suggest that more equitable land and water distribution will have significant direct impacts on poverty, which are even greater than the anti-poverty impact of increases in productivity.

05. Impacts of irrigation on poverty alleviation:

a) Irrigation has a strong land augmenting impact; the value of per hectare crop production under irrigated settings is about twice than in rain-fed settings. Quantitative evidence shows that household income and consumption are much higher in irrigated settings than in rain-fed settings, and a 50 percent point gap is not uncommon. In most settings, poverty incidence is 20-30 percent higher in rain-fed settings than in irrigated settings; irrigated systems have much lower chronic poverty than rain-fed settings; the study suggests that irrigation significantly contributes to reducing the worst kind of poverty, i.e., chronic poverty.

b) Indirect impacts of irrigation on incomes and poverty are much larger than direct impacts. Direct productivity-related antipoverty impacts of irrigation are only one-third of total impacts in the command areas, and the impacts are much higher when economy-wide multiplier impacts are also accounted for. Further, there are complementarities between public-sector investments in canal irrigation and private-sector investments in

irrigation and other related sectors by farmers (such as investments in groundwater development). Overall, the study suggests that investments in large and medium-scale canal irrigation systems attract private-sector investments in small-scale irrigated agriculture and other related sectors.

c) The study finds that there are indicative patterns of poverty in large and medium-scale canal systems, where, in general, poverty is significantly lower at middle reaches than that at head and tail reaches; poverty is high where availability and access to surface water is low, groundwater quality is poor, agricultural productivity is low and opportunities in the nonfarm sector are limited.

d) Areas where communities and households depend to a great extent on agriculture for their livelihoods, access to irrigation is a necessary but not a sufficient condition for poverty alleviation; access to other production inputs and services by the poor small and marginal farmers is also important to enhance benefits of irrigation for poverty alleviation.

e) The study concludes that the magnitude of poverty-reducing impacts of irrigation varies significantly across and within irrigation systems from very high to very low or even negative, and that irrigation investments do not automatically reduce poverty. Irrigation can be strongly pro-poor, neutral or even anti-poor depending on a range of conditions, which include: *i) condition of irrigation infrastructure and its management, ii) irrigation water allocation and distribution procedures and practices, iii) access to modern resource conserving and production technologies, cropping patterns and diversification to high-value crops and enterprises, and iv) support measures (e.g., information, input and output marketing), and v) access to land, its distribution structure, and its quality.* In systems where these conditions are relatively favorable, irrigation has strong antipoverty impacts.

06. Irrigation system performance and poverty linkages:

a) The values of performance indicators (productivity, equity and water supply, economic and financial sustainability, institutional/management) vary significantly across the systems studied. In general, performance of the systems is better in Southeast Asian and Chinese systems compared to those in South Asian systems. Performance is lowest in systems studied in Pakistan and Bangladesh. Also, the performance is lowest in systems managed by government agencies while it is relatively better in the transferred systems where management of the systems is more participatory. Econometric analysis shows that performance of irrigation systems is a significant determinant of poverty especially in South Asian systems, that is, poverty is high in poorly performing systems compared to relatively better-performing systems.

b) In South Asian systems, lack of effective decentralized institutions, lack of incentives and accountability mechanisms, and inadequate funding resulting from low level of charges and poor collection efficiency, are fundamental causes of poor service delivery and poor system performance. Econometric analysis shows the type of management

institutions (centralized/participatory) and the level of irrigation charge significantly influence system performance that, in turn, affects poverty in the systems. Where irrigation management is more participatory and irrigation charges are at a reasonable level, performance is better and poverty is relatively low.

07. Irrigation Service Charging—Implications for the Poor:

a) In South Asian systems, irrigation charges are not linked to irrigation service delivery. In these systems, revenues from irrigation charges are remitted to the government and there is no direct link between funds collected and funds spent on operation and maintenance (O&M). However, in the Chinese and Vietnamese systems, irrigation charges tend to be related to the level of service and O&M costs e.g., full charges for full service and partial charges for partial service. On the other hand, multiple criteria (such as cropped/irrigated area, crop type, crop productivity, location, level of service and users' capacity to pay) are used in charging for irrigation in the transferred systems in Indonesia. Overall, irrigation charge collection efficiency is generally high in systems with better performance, generally those having decentralized arrangements for spending of collected revenues.

b) The level of irrigation charge is much lower in South Asian systems than that in Southeast Asian and Chinese systems. In South Asian systems, the level of annual irrigation charges varies from US$4.6/ha to US$22/ha compared to Chinese (US$26 to US$76/ha) and Vietnamese systems (US$58 to US$61/ha).

c) The consequences of low level of irrigation charges in the South Asian systems are multifold, as low level of charges leads to: poor maintenance and overall performance of systems, and affects the poor's access to water; creates disincentives for farmers and service providers; weakens accountability linkages between managers and farmers, and leads to the vicious circle of poor performance in irrigation; resulting in inefficient production, and worsening income and resource disparity between the poor and the nonpoor, particularly in settings where land distribution is highly inequitable. The study suggests that it is not only the level of charge that is important but also charge collection and spending procedures.

d) The study indicates that the poor small and marginal farmers are, in general, not only more than willing to pay, in some cases, but they are already paying more for irrigation than large and nonpoor farmers. Detailed analyses for Pakistani systems indicate that the poor small and marginal farmers pay more in total annual per hectare cost of irrigation than large and nonpoor farmers. They pay more in canal water charges, as the charge is based on cropping intensity, which is generally higher on smaller size farms; and also because smaller-size farms make greater use of groundwater on a per hectare basis which they mostly buy (and which is around 9 times expensive than canal water) because of their less access to canal water. This also implies that marginal returns from irrigation are nine times the present canal irrigation charge [on average groundwater cost constitutes over 20% of gross value of production (GVP) per hectare compared to canal water that

constitutes only 2.5 percent of GVP per hectare]. These figures suggest that the increase in canal water charge is justifiable on the basis of returns from irrigation.

e) For Pakistani systems, the study analyzes the implications for the poor of three irrigation charge policy options: option 1: present charge policy; option 2: flat rate policy - flat rate per unit of irrigated land based on land size, independent of crop type and cropping intensities, that is, present average irrigation charge applied uniformly across all farm size categories; and option 3: differential rate policy - differential rate per unit of irrigated land based on land size, applied differentially across various farm size categories—progressive rate structure similar to increasing block rate charging—lower irrigation charge for the first two hectares, applied uniformly to all land size categories, and charge increases progressively with increase in size of landholdings above 2 hectares, by Rs 50/ha for each successive category of land size. The analysis suggests that the present charging policy is pro-large farmers and that a flat rate policy would be more equitable and a differential rate policy would be pro-poor. With policy option 3 adopted for the country as whole, over Rs 1,362 million would be redistributed with a significant part in favor of poor small landholders. Option 3 is better than both options 1 and 2 from revenue and equity perspectives. Option 2 is relatively equitable; option 3 is pro-poor, as per hectare irrigation charge to the poor would be less than that of the nonpoor, and would be significantly less than that for options 1 and 2. Option 3 is a win-win scenario in terms of cost recovery and benefits to the poor. The study results indicate that the present irrigation charge policies are hurting the poor, mostly indirectly but also directly in some cases. Overall, the study findings imply that the low level of charges applied uniformly to all socioeconomic groups of farmers is disadvantageous to the poor, as it adversely affects the system performance, which is one of the important causes of poverty in South Asian systems.

08. Institutional Reforms in Irrigation Sector: Implications for the Poor

a) Institutional reforms in large and medium-scale systems, mostly initiated since the mid-1990s, are presently underway in all the study countries, though the progress is slow in Bangladesh, Pakistan and Indonesia compared to India, China and Vietnam. The reforms focus on three major areas: formulation of irrigation water policies, development of legal and regulatory frameworks and changes in irrigation finance/charging policies and establishment of new institutions for participatory irrigation management (PIM) /Irrigation Management Transfer (IMT). New irrigation/water policies and laws have recently been formulated in the study countries, but their enforcement and implementation is yet to be realized. While the new policies do recognize the role of water resources in poverty alleviation, in most cases, there are no explicit policy principles addressing poverty concerns or any specific pro-poor provisions in the policy documents.

b) The new institutional arrangement for irrigation management consists of a three-tier organizational structure in the medium and large-scale canal systems in six countries. In almost all the systems in South Asian countries and in Indonesia, the new structure has been implemented only partially, where while tertiary- and secondary-level organizations have been established, primary-level organizations have either not yet been established in

most cases or they are not yet functional. O&M grants have provided significant incentives to new tertiary- and secondary-level organizations to be functional. So far, where established the new management organizations have been undertaking activities related to hardware of irrigation, that is, maintenance of infrastructure, with only little attention to the software side of irrigation management including water allocation and distribution.

d) In systems where reforms have been implemented, they have led to improved maintenance of infrastructure, increased crop productivity, reduced inequities in water distribution and increased funding, but given that reform implementation is a recent phenomenon, the full range of their impacts remains to be seen. Results from the systems studied in India and Pakistan show that reforms have led to improved O&M of systems, increased irrigated crop areas (e.g., crop areas in Hakra-4R system increased by 6%), increased crop productivity (e.g., crop yields of paddy and maize in Andhra Pradesh systems increased by around 20%), increase in equity in water distribution (e.g., improvements in head-tail equity ratio of 1 in Hakra-4R systems in Pakistan), increase in irrigation charges (e.g., irrigation charges in Andhra Pradesh increased three and half times from Rs 100-150/ha to Rs 500/ha after reforms), improvements in collection rates (e.g., collection rate increased to 88% and 95% in the transferred systems in Pakistan and Indonesia, respectively), cost effectiveness in O&M works, and improvements in reliability and access to water at tail ends. Other benefits of reforms included reduction in water theft, reduction in litigation cases related to irrigation water and reduction or elimination of rent-seeking by irrigation officials, improved assessment of water charges, and increased information-sharing among farmers.

e) The study results show that the reforms have benefited the poor in three ways: i) increase in O&M works undertaken after the implementation of reforms has generally benefited the landless, and marginal and small farmers by creating more employment opportunities for them; ii) improved reliability and equity in water sharing, increased access to water at tail ends where there is relatively more poverty and resulting increased productivity and returns to farming; and iii) other monetary and nonmonetary benefits from improved management and system performance such as reduction in water- related disputes, increased information sharing, community empowerment, increased employment opportunities for wage earning resulting from overall increased productivity—all these can be considered as important pro-poor aspects of reforms. However, there have also been concerns in South Asian systems that prevailing high inequities in land distribution may lead to a situation where the irrigation reforms may end up empowering the already powerful groups and reinforcing the dominance of local influential people and large landholders in user groups, particularly in Bangladesh and Pakistan.In Indian systems, some of the water-user group presidents are reported to be operating more like contractors forming an unholy nexus with irrigation officials and competent authorities.

f) The study suggests that successful implementation, effectiveness and pro-poorness of institutional reforms depend upon a range of conditions. Reforms are likely to succeed where i) landholdings are fairly equitably distributed; ii) socioeconomic differentiation

among users or groups of users is less, and communities within systems are fairly homogenous; iii) irrigated agriculture is profitable and benefits of irrigation to farmers are significant; iv) there are incentives for managers and management organizations to improve service delivery; and there is commercial orientation of management institutions, and accountability mechanisms are in place; and v) cost of canal irrigation is fairly high i.e., farmers incur higher costs in irrigation charges. Where such conditions are not favorable, it will take a relatively longer period of time for reform initiatives to be successful and effective. Enforcement of strict regulatory measures will remain crucial to avoid any negative impacts on the poor.

g) The newly created organizations/water user groups in all the studied systems are single functional, i.e., irrigation/water management. In the initial phase of reforms, these organizations may be functional due to financial incentives given to them by governments and donors in the form of grant funds for carrying out necessary activities. However, in the long run, their continued functioning and sustainability and members' participation will depend on the incentives they face, and they are likely to remain functional if they are made multifunctional with some commercial orientation.

h) On institutional reforms, the study concludes that so far reforms have been implemented only partially in terms of spatial scale (i.e., coverage of systems), organizational structure (i.e., tiers of new management structures) and management functions (i.e., infrastructural management vs. water management). Given the time period of reforms and scale of coverage, it is too early to assess the full range of impacts of reforms. However, early indications are that reform initiatives have led to improved irrigation performance and water use efficiency, increased productivity and farm incomes, and the poor have also benefited both directly and indirectly. The irrigation sector reforms have important pro-poor aspects. The study suggests that the reforms should not be delayed even if benefits to the poor are not very visible in the short run, and efforts should be made to make them pro-poor. Proper sequencing of activities, incentives, and effective leaderships are keys in the early period of reform implementation.

09 Other aspects—crop diversification, resource conserving technologies and integrated service delivery:

a) Agricultural diversification towards high-value crops and enterprises enhance the value of irrigation water, generates employment opportunities and reduces poverty significantly.

b) Resource conserving technologies enhance the value of irrigation water and returns to farming: the study results, for Indian and Pakistani systems, suggest that small-scale cultivation and resource-conserving technologies, such as the bed and furrow method, zero tillage technology, precision land leveling, and precision irrigation lead to water saving by 20–30 percent, labor saving by over 30 percent, crop yield increases by 15–20 percent; all these factors reduce the cost of production and improve returns to farming.

However, so far, dissemination and adoption of these technologies remain limited and patchy due to deficiencies in institutional arrangements for delivery of these technologies.

c) The value of irrigation water varies from US$0.004/$m^3$ to US$0.38/$m^3$ in the studied systems, with higher values for Chinese and Vietnamese systems than for South Asian systems. Further, the study indicates that the value of irrigation water is many times more when all direct and indirect broader-level benefits and impacts of water are accounted for. For example, in Pakistan, the value of irrigation water increases from US$0.04/$m^3$ (in terms of productivity-related benefits) to US$0.12/$m^3$ when local-level benefits from other uses of water are also accounted for, which further increases to US$0.24/$m^3$ when local-level social benefits of poverty reduction are also accounted for. These local-level estimates increase to US$0.48/$m^3$ when quantifiable major direct and indirect national-level economic and social benefits are accounted for. Therefore, the study suggests that the value of irrigation water is not as low as it is generally estimated or perceived when all major uses and impacts of irrigation water at various levels are properly accounted for. Further, the results suggest that the value of irrigation water is increasing over time, not only because of increasing scarcity of water but also because of increase in the share of high-value farm enterprises, such as high-value crops, livestock and fisheries.

d) The study suggests that agricultural productivity and value of water to the poor can be enhanced with delivery of key inputs and services through integrated approaches with public-private sector partnerships. The study offers a framework for implementation of this approach.

10. Overall, the study concludes that a) in South Asian irrigation systems, poverty is high among households and communities that are poor in land, water, productivity and education but rich in unskilled labor, and inequity in distribution of these resources is the principle cause of poverty; b) investments in irrigation are not always pro-poor, the magnitude of antipoverty impacts of irrigation depends on a range of conditions, and irrigation can be strongly pro-poor, neutral or even anti-poor depending on these conditions; c) there are indicative patterns of poverty in most irrigation systems in South Asia, with poverty higher and deeper in tail reaches and lower in middle reaches; d) the study concludes that South Asia has only partially benefited from past investments in irrigation, where performance of most systems remains poor due to lack of adequate funding, inefficient spending and nonincentive-based poor management/institutional arrangements, and that there is tremendous scope to improve irrigation performance through effective interventions in these areas with significant positive impacts on poverty reduction; e) the present policy of low irrigation charges in South Asian systems creates disincentives for farmers and managers/service providers, weakens accountability linkages between them, and leads to the vicious circle of poor system performance, and the low charge policy applied uniformly to all socioeconomic groups, as is the case in all the systems studied in South Asia, is disadvantageous to the poor; f) agricultural diversification toward high-value crops and other farm enterprises, resource-conserving technologies, and integrated approaches to service delivery in agriculture enhance benefits of irrigation to the poor. Overall, the study suggests that there are many lessons

that South Asia can learn from Chinese and Southeast Asian experiences in water-sector reforms.

11. The study identifies examples of conditions, institutions, management practices and initiatives that may be regarded as better practices or have good potential to be a better practice. These better practices when adopted together, may make an ideal irrigation system with poverty situation substantially improved. These include:

a) China: The distribution of land to the landless through effective land reforms and overall equity in land and water distribution; decoupled land and water rights; relatively more investments in downstream areas; and initiation of financial incentive-based irrigation management.
b) Vietnam: The establishment of Irrigation and Drainage Management Companies, and Irrigation Enterprises as financially autonomous bodies with commercial orientation; multifunctional service Cooperatives; pro-poor land tax system and irrigation service fee (i.e., discriminatory land tax and irrigation fee in favor of the poor where poor pay 50% less tax and fee than the nonpoor); policy of irrigation-service charges linked to service delivery (i.e., partial charges for partial irrigation service); and policy of irrigation charge reduction during drought periods.
c) Indonesia: The formulation of people-based comprehensive irrigation management reform policy; and multiple-criteria-based irrigation charging practice, charge differentiation by geographic location and socioeconomic groups (such as the poor and those in disadvantaged locations such as tail ends of the systems paying relatively less) in the transferred systems.
d) India: The large-scale/state-wide implementation of reforms for PIM through the "big bang" approach; and increases in irrigation service charging after management transfer; and system of advance payments for irrigation charges in some states.
e) Pakistan: The *warabandi* system of water rights and distribution at the tertiary level, that if implemented effectively, ensures equity in water distribution across locations and seasons; recent initiatives for computerizing land records; and emerging initiatives to integrating delivery of production inputs and related services to farmers.
f) Bangladesh: The establishment of labor-contracting societies (LCS), embankment maintenance groups (EMG), channel maintenance groups (CMG) for providing employment and income-generating opportunities to the landless men and women.

12. Broadly speaking our studies suggest that China and Vietnam have followed the strategy of "distribute first" and grow, which has been largely successful in reducing chronic poverty or has created favorable conditions for rapid poverty reduction. On the other hand, South Asian countries have adopted the "grow first"' strategy, largely ignoring the distribution issues which has met with limited success in reducing poverty and has not led to favorable conditions for rapid poverty reduction. For China and Vietnam, the challenge is largely to sustain the high rate of growth, while South Asia is faced with enormous challenges of improving both distribution and growth.

Pro-poor Intervention Strategies

Based on the lessons learnt from cross-system and cross-country comparisons of diverse situations, and inputs from a wide range of stakeholders including farmers, non-government organizations (NGOs), policymakers, and research and development professionals, the study develops strategies and identifies specific interventions and actions and provides guidelines for their effective implementation. These are summarized below.

13. Inequities in distribution of land, water, productivity and education, and lack of opportunities for unskilled labor in agriculture are identified as principal causes of poverty in South Asian irrigated agricultural systems. High inequities in resource distribution not only hurt the poor, but reduce growth in agricultural productivity and also cause delays in much-needed reforms in the agriculture sector. Correcting existing inequities, particularly in resource distribution, would not only be good for the poor, but is something important for laying the solid foundation for strong rural economies. Without correcting the fundamental problem of inequities in resources distribution, policies addressing only peripheral issues will not be effective in achieving the objective of poverty reduction [The Chinese example of bringing equities in land distribution through effective land reforms in early stages of development and its contribution to equity in benefits of investments in the irrigation sector and ultimately in reducing poverty offers very important lessons]. In this regard, the study makes the following recommendations:

    a) The first and the basic step is to create an enabling environment for poverty reduction through development and strengthening of policies and strategies (specifically related to poverty reduction, land, agriculture and water sector) and linking these policies under a consistent framework. If the commitment to poverty reduction is genuine, then the objective of poverty reduction must drive the process of related policy formulation and institutional development, not the other way round.

    b) Three major routes to rural poverty reduction as identified in this study are: i) land- and agricultural productivity-based growth and development through pro-poor interventions (*lands)*; ii) labor-intensive nonfarm-sector-based growth and development through pro-poor interventions (*hands)*; and iii) combination of 1 and 2, i.e., (*both lands and hands)*. In the context of South Asian systems, while the third approach would be important in the long run, the first approach remains fundamental for creating conditions and laying a solid foundation for the second approach to be effective.

    c) Promoting equity in resource distribution and creating permanent assets for the poor should be at the forefront of the poverty-alleviation strategy. Lack of access to land and water and low or no skills/education for employment are identified in this study as the principal causes of poverty, especially in South Asian irrigated systems. While education/skill development is a key to improving human quality and reducing poverty, it generates outcomes over a longer period of time. In the short and medium term, improving the access of the rural poor to resources and assets, such as land and water, and improving their quality where the poor already own such assets, would be a *strongly*

pro-poor strategy and would create conditions for lifting people out of poverty on a permanent basis. Experience shows that successful redistribution of lands to the poor through effective land reforms in Japan in 1948, Taiwan in 1953, South Korea in 1948, China from the 1950s to the late 1970s under economic reform, and Vietnam in 1986 under *doi moi* reforms has contributed tremendously to lifting a large majority of the poor out of poverty, mostly on a permanent basis, in these countries. On the other hand, land redistribution attempts made through administrative reforms in India achieved only limited success. Land reforms in Pakistan and Bangladesh largely failed to achieve desired results either due to poor records on landholdings or poor implementation of regulations.

Other recent studies also support the findings of this study, which concludes that inequity in land distribution impedes economic growth and development; smaller-size family farms are more efficient, labor-intensive, productive and environmental friendly than large farms in developing countries; and that land distribution to the poorest people has a strong positive relationship to poverty reduction. With the growing realization of these issues, land reform, which once became a taboo subject, is back on the mainstream development agenda, although there are strong controversies on approaches to land reforms.

The study offers three options for correcting broader-level inequities in land and water and for improving access of the poor to these resources: a) make radical changes in the land distribution structure, through ceiling-based regulatory/administrative land reforms for equitable distribution of land. However, this option is not very realistic and is unlikely to succeed under the prevailing sociopolitical scenarios; b) promote equity in land distribution and improve access of the poor to land through a combination of ceiling-based regulatory approach and incentive-based market approach; however, this semi-targeted approach, though attractive may not be feasible due to huge costs involved; c) improve the chronic poor's access to land through an incentive-based market approach, with emphasis on providing basic-size holdings to the chronic poor, that is economically viable and generates livelihoods sufficient enough to support an average family. This option entails relatively less cost; and this is something doable and should be done. The emphasis should be on creating economically viable, managerially efficient, socially equitable and locationally consolidated landholdings for the chronic poor. The newly initiated irrigation-sector reforms could provide an important entry point for the suggested land distribution initiative, starting with distribution of available public lands. The development of an electronic database of land records, and simplification of land transaction procedures should form important elements of the strategy.

The study suggests that the proposed initiative for land to the chronic poor would be effective only if the following preconditions are met i) land distribution and the access of the poor to land does not lead to heavy debt burdens on the poor households; ii) landholdings are of reasonable size to support a family and land is of good quality and productive; iii) land distributed to the poor is free from disputes; iv) the new owners are given the right to hold title to land with regulation on possible resale of land; and v) land

distribution is accompanied with a package of support services (such as credit, technology, information, market links).

d. Enhance benefits of existing resources to the poor smallholders. In this regard, it is suggested to: i) avoid policies that lead to excessive fragmentation of landholdings, and develop effective strategies for consolidation of fragmented land parcels into economically viable units; and ii) give priority to smallholder farms for land quality improvements. It is necessary to raise awareness on land-quality issues, on cost-effective measures to address problems such as salinity and waterlogging with improved irrigation practices, and land-use patterns and on chemical and biological measures through media and by involvement of local NGOs. Newly created organizations, such as local water user groups/associations, can also be used as vehicles for dissemination of these technologies and measures.

14. Develop separate models for poverty alleviation. In the past, poverty alleviation initiatives have often tended to approach the problem by taking one model fit for all situations, which tends to ignore many specifics of poverty across socioeconomics groups and geographic locations. As shown in the study, the nature of the poverty problem is different across various socioeconomic groups (chronic poor vs. temporary poor; landless and land-poor vs. landholders; nonfarmers vs. farmers) and across locations (rain-fed and marginal areas vs. irrigated areas; downstream vs. upstream areas; groundwater-poor vs. groundwater-rich areas; water-short vs. water-adequate/abundant areas; areas with no or little diversification vs. areas with greater diversification such as paddy and non-paddy growing areas), and there is no single model that fits all these situations. Separate models are needed for these situations. The former groups and areas generally need long-term interventions through the development of resources/infrastructure to improve average incomes while the later groups/areas need interventions that help maintain already achieved relatively higher average incomes. For effective poverty alleviation, the interventions have to be tailored to the specifics of poverty for each of these situations. Also, the former groups and areas call for relatively greater investments than the latter; but the impacts on poverty alleviation of such investments will be much more intense for these areas/groups. For the former groups/areas, the public sector should play a key role (at least in the initial stages), while for the latter groups/areas, the private sector including NGOs' role should be promoted.

15. Promote integrated delivery of inputs, technologies, information and other services for productivity improvements in agriculture through public-private-sector partnerships: one of the principal causes of low productivity in South Asian systems is lack of timely access to adequate good-quality inputs such as seeds, chemical fertilizers, micro-finance, etc., productivity-enhancing and resource-conserving technologies and better practices, information, and other related services including output markets, where transaction costs are high not only in the delivery of such services but also in accessing these services by farmers. This is largely because institutional mechanisms that can help provide access to these factors and services either do not exist or they are fragmentary, of poor quality, limited in capacity, and often inefficient, exploitative and anti-poor. The delivery and

access to these services by farmers can be improved by integrating them into a package and involving the private sector in the delivery of these services.

16. Innovate irrigation management with pro-market and pro-poor orientation: priority areas include:

a) Move forward irrigation-sector institutional reforms with a pro-poor orientation, with priority given to: creating conditions for reforms particularly in Pakistan and Bangladesh, replicating and up scaling recent reform initiatives, expanding the coverage of newly created tertiary-level organizations/water-user groups in terms of their functions (water allocation, in addition to physical infrastructure maintenance works), and strengthening or establishing the second and third tiers which either do not exist or weak in most cases of the three-tier reform framework; and importantly, developing strategies for sustainability of organizations. Proper sequencing of reform activities is crucial.

b) Develop strategies for continued functioning and long term sustainability of newly created water user/management groups when O&M grants from public agencies and donors are no longer available. The new organizations are likely to succeed if they are made multifunctional with some commercial orientation. In the long run, irrigation institutions need to integrate and link their central task of irrigation management and service delivery to broader agricultural productivity and poverty-alleviation objectives.

c) Reorient irrigation service delivery with commercial principles and incentives, with enhanced accountability and regulatory backup, as lack of commercial orientation, weak or no incentives in management, absence of accountability and effective regulatory backup are the fundamental causes of poor service delivery in the irrigation sector. Specific measures include linking service delivery to irrigation charge/payment (only those who pay fully get full service, those who pay partially get only partial service), offering monetary incentives to managers/service providers, and establishing and implementing accountability procedures and linkages.

d) Make the irrigation sector financially self-sufficient: continuing financial dependence of the irrigation sector on public-sector budgetary allocations, which are often inadequate, is one of the major causes of poor system performance and poor service delivery. This, in turn, is the outcome of low revenue from poor collection of low irrigation charges that, particularly in South Asian systems, are neither linked to service delivery and O&M costs nor they reflect the value of water. A financially self-sufficient irrigation system is good for service delivery and also for the poor. Specific actions in this area include: i) correct charging structures, link irrigation charges to service delivery;

ii) increase charges to the level that at least covers reasonable O&M costs; and gradually move away from the irrigation water tax concept to irrigation service fee, towards more differentiated irrigation service fee, and gradually towards irrigation water pricing; iii) introduce and promote a system of advance payments (i.e. move away from the “first come, first served” approach to “first pay and first served” approach) for service delivery charges to strengthen accountability linkages between service providers and users, and to

improve on collection efficiency and overall cost recovery, leading to financial self-sufficiency of the sector.

e) Set performance standards and poverty alleviation targets in irrigation systems: irrigation system performance and service delivery must be guided by performance standards and poverty alleviation targets, not the other way round. Irrigation managers and/or organizations should be required to meet certain standards in terms of infrastructural maintenance, financial self-sufficiency, equity in water allocation and distribution, water use efficiency and productivity, environmental sustainability and poverty alleviation by setting clear and realistic standards through regular performance assessments and monitoring.

f) Reorient water rights and allocations with pro-market, pro-equity and pro-poor approaches as the poor marginal and small farmers mostly rely on, and prefer to buy/pay for goods and services in markets (i.e., groundwater markets); market-based allocations actually benefit the poor smallholders and, importantly, greater equity in water allocation and rights increase productivity and efficiency of water use, and both are good for the poor. The study suggests that water rights and allocations at all levels should be based on or reflect the following: i) cost of supplying canal water (and, in the long run, value of water to the society); ii) equity in water allocation across socioeconomic groups (small vs. large farmers) and across upstream and downstream areas in canal systems; and iii) priority in canal water allocations to disadvantaged areas and communities in irrigation systems.

17. Enhance benefits of past and new investments in irrigation to the poor: The study clearly brings out that the poor in South Asia have only partially benefited from past investments in canal irrigation due to a variety of constraints. Canal irrigation could be and should be made strongly pro-poor and the overall benefits of irrigation to the society could be enhanced by adopting the following approaches: i**)** integrating management of surface water and groundwater; ii) promoting agricultural diversification towards high- value crops and enterprises; and iii) promoting delivery and adoption of resource- conservation technologies.

18. Develop capacity and real empowerment (C&E) through raising mass-scale awareness and skill development with opportunities to use the acquired skills. Efforts should focus on regular updating of policymakers, creating new water leaders, empowering of existing local-level leaders, managers, and farmer's representatives, and importantly, cross-fertilization of ideas and cross-country promotion of better practices.

19. Other important considerations related to poverty alleviation strategies:

a) Poverty-alleviation efforts that are based on initiatives coming from governments themselves are more likely to succeed and be effective than those that are simply the outcomes of pressures from agreements with donors that often require meeting certain targets in specific time periods and often ignoring the prerequisite or necessary conditions required for certain initiatives, although sometime pressures and interventions from

donors are helpful. Interventions that are based on unrealistic targets and strict deadlines attached to them, ignoring the appropriate process to be followed end up being successful more on the paper than on the ground.

b) It is important to move away from *ad hoc* and temporary approaches to poverty alleviation towards more solid solutions that help lay strong foundations and that help create conditions for lifting the poor out of poverty permanently. Peripheral and temporary solutions are not only more costly but often have no long-lasting impacts.

c) Where socioeconomic fundamentals and basic conditions are favorable, a small intervention would have significant impacts on poverty; on the other hand, where basics are missing and necessary conditions are not in place, many interventions may result in only limited success. Therefore, priority must be placed on getting the basics rights and creating conditions conducive to large-scale poverty reduction over any interventions that appear to reduce poverty directly in the short term but at a limited scale.

d) Often, when political leadership in a developing country changes, past policies and strategies, including those with good potential, also change and in many cases such undue changes are the main causes of failure of even those interventions that have good potential for poverty alleviation. Developing and promoting strategies that enhance long-term continuity of potentially effective poverty-alleviation interventions should be an important step in this direction. Equally important is to ensure consistency in related policies, i.e., water-sector policies, agricultural development policies, rural development and poverty-alleviation policies/strategies.

20. Other important considerations related to institutional reform implementation: on institutional reforms, specifically in relation to participatory management and system handover, questions often arise as to whether the reform implementation should be a slow and gradual process or a quick “big bang” approach; whether the reform approach should be top-down or bottom-up; and in a hierarchy of canal systems management levels (tertiary, secondary and primary), which level should be managed by farmer organizations/service providers and at which level the public-sector agencies should play a greater role. The outcomes from experiences on these issues are mixed, and the questions remain controversial. The experience with reform so far suggests that where the reform implementation is based on unrealistic targets and strict deadlines attached to them, ignoring the appropriate process to be followed often end up being successful more on the paper than on the ground (e.g., formation of water user groups in Bangladesh); on the other hand, where the reform process is very slow, it often leads to incomplete implementation of the reform model not only geographically but also in terms of organizational structure, and it remains an unfinished agenda for quite sometime. However, based on our experiences in this study, it is suggested that reform should not be too slow to not lose the whole spirit and the purpose on the way, but that it also should not be too fast in the sense that it must go through the essential process for long-term success and sustainability of the initiatives. It is important to have targets and a time frame but, of course, more realistic targets and a time frame considering the fact that reform by nature is a slow process. While too much piloting slows down the whole

process, piloting of reform interventions at the initial stages through action research is important.

On the top-down vs. bottom-up approach, the initiation and implementation of reforms need a clear vision and firm commitment from the top leadership, both political and policymaking, to succeed. While bottom-up initiatives and support from below are important, initiatives from the top are generally key to move the reform agenda forward faster. The question of which level should be managed by whom depends on the size, the complexity of the systems, and cost of information collection. Generally, the larger-size systems are more complex than smaller systems, and within larger systems, complexity increases at the higher levels, which require specialized professional skills for operations and management. While water-user groups and private local-level organizations are best suited to manage tertiary and secondary levels, public/semipublic agencies may be required to carryout planning and more complex works at the primary levels.

21. Project outputs, impacts and follow-up:

a) During the project implementation period significant achievements were made in areas including: i) partnership development, stakeholder participation and awareness raising, ii) communication and output dissemination, iii) publishing of outputs iv) capacity development and support to NARES, and v) project effect/impacts. The study involved national partners in each of the six countries. More than 7,640 stakeholders, including women, participated in the study directly or indirectly. These included international donors, politicians, national-level policymakers, national and international researchers, the academic community, NGOs, journalists, practitioners, local-level managers, community leaders and rural farm and nonfarm households.

b) The project raised mass-scale awareness of the issues related to water and poverty and actively disseminated the project findings at various levels through 31 formal presentations at the global, regional and national levels; media briefings and reporting (including 45 news/briefs in national newspapers, 13 news items at the radio and the TV); publications and dissemination of written outputs including scientific papers, articles and reports, a project-specific website, and through community-level group discussions and dialogues, participatory assessments and demonstrations (e.g., of technologies and best practices). In addition to presentations made at various fora, the project organized 13 workshops where 786 stakeholders participated, learned about the project and provided input into it.

c) The key project outputs included: i) inventory of issues related to water and poverty in irrigated agriculture in the region, ii) inventory of global literature on water and poverty in agriculture, iii) documentation of the current situation and problems related to irrigated system performance, productivity and poverty in the selected systems, iv) a set of pro-poor interventions, actions and implementation strategies and guidelines, v) irrigation-poverty profiles for the six study countries covering a range of related aspects at macro, meso and micro levels, vi) a large database consisting of primary data from 5,408 households from 26 irrigation systems, vii) over 79 reports/research papers and articles

and other material, and viii) awareness-raising and dissemination of pro-poor interventions and strategies.

d). The project involved 227 professionals in implementing the project including 57 female professionals and 189 junior professions, of which 134 received training through 19 formal training programs. In addition, the project provided financial support to 6 Masters' students and 2 Ph.D. students, and offered opportunities to 5 young postdocs to gain experience in carrying out complex research.

e) In addition to the above achievements, the project contributed to enhancing the understating of the issues and better practices in water management and poverty alleviation at various levels: from policymaking to the household levels. At the higher level, the project strategically involved national water and poverty experts engaged in the formulation of related policies for cross-fertilization of the issues and options in these areas. This has led to some key developments at various levels, particularly in Pakistan, the only country in the region where poverty is not only high but has been increasing in recent times where: i) a national level NGO implementing poverty alleviation interventions is reported to be taking up some of the lessons learnt from the project and is broadening its scope to include water/irrigation as one of its core areas and is developing new initiatives including developing separate models for irrigated and rain-fed areas, initiatives for strengthening upstream downstream linkages, and active dissemination of small-scale resource-conserving technologies; ii) the new concept of integrated services delivery in agriculture that emerged from the project findings is being widely discussed at higher-level policy circles, and iii) recently, the Punjab Irrigation Minister has expressed interest for initiating pilot projects on some of these new ideas/concepts, particularly those related to integrated services-delivery and multifunctionality of water-user groups for the development of smallholder economies at the Lower Jehlum Canal.

f) For an immediate follow-up to the outcomes and impacts of the project, IWMI has submitted a proposal for action-oriented R&D on one of the strategic interventions proposed in the project "*Integrated Service Provision for Poor Farmers in Irrigated Agriculture through Public-Private Sector Partnerships***"** to the ADB for improving service delivery in irrigated agriculture and for exploring the potential for making recently formed water user groups'/WUAs' multifunctional and for using them as vehicles for delivery of inputs, technologies and services in an integrated framework.

Finally, what we learnt about poverty from the several thousand persons during our fieldwork in the six countries is that poverty is nothing but a reflection of inequities, injustices, insecurities and ignorance—in resources, opportunities, institutions and technologies.

The poverty of our century is unlike that of any other. It is not, as poverty was before, the result of natural scarcity, but of a set of priorities imposed upon the rest of the world by the rich (John Berger).

Part I

Background, Settings, Summary and Synthesis of Findings, Conclusions and Pro-Poor Intervention Strategies

This part of the report provides a summary and synthesis of main findings, conclusions and lessons learnt from studies in six countries. These are based on a synthesis of country studies and some additional analyses using data from primary sources or those presented in the country reports. Summaries of main findings, conclusions and recommendations for each country are provided in part II of the report. This part is organized into three sections: the first section summarizes the study background, objectives, key hypotheses, discusses various concepts and approaches to understanding and addressing the poverty problem, clarifies the meaning of the term "prop-poor intervention" as applied in this study, and outlines unique features of this study. The second section describes characteristics of the study settings and outlines study methods. The third section presents the main findings, key lessons and conclusions and a set of identified pro-poor interventions and actions. Country-specific details can be found in part II of this report and more elaborative discussions and technical aspects are provided in the individual country reports. Part I is organized into the following four chapters.

V. Study Background
VI. Study Setting, Data and Methods
VII. Summary and Synthesis of Findings and Conclusions
VIII. Pro-Poor Intervention Strategies and Guidelines

Chapter 1

Study Background

Agriculture in developing Asia as a whole has made remarkable progress over the past three decades. Between 1970 and 1995, cereal production more than doubled from over 300 million metric tons (mt) to 650 million mt, while the population increased during the same period by 60 percent. This remarkable growth in food production was largely attributed to growth in irrigated agriculture, coupled with the use of high-yielding varieties of crops and the application of fertilizers and pesticides. At present about 40 percent of the cropland in Asia is irrigated and accounts for about 70 percent of total cereal production. Irrigation has greatly improved the incomes of farmers with access to fertile and well-drained land, reliable water supplies, yield-enhancing inputs, and credit as well as other supporting services. It has also benefited the overall population by providing more food at reduced prices.

Despite these achievements, the productivity of a large part of irrigation systems remains severely constrained by insufficiency of some or all of these inputs. Such low-productivity areas are characterized by persistent rural poverty. The distribution of the benefits from irrigation development is thus largely skewed and unequal. While the determinants of low productivity are numerous and complex they are, to a large extent, associated with poor performance of many of the established irrigation systems. This causes low, inequitable and unreliable water supplies in those areas. It has been widely acknowledged that actual irrigated area in many of the irrigation schemes is much smaller than planned. Large areas within the irrigation schemes suffer from chronic and severe water shortages, especially in the tail-end reaches. Large-scale waterlogging has also been reported. It is now widely understood that these are largely caused by institutional and managerial factors, poor governance and lack of funds for maintenance rather than by technical constraints, which could be addressed without large physical interventions but with greater cost-effectiveness benefiting the poor. A number of other determinants contribute to poverty in the low-productivity irrigated areas: a) physical factors such as poor design, unsuitable topography, poor drainage, poor soil conditions; b) economic constraints such as smaller landholdings, lack of financial resources and credit, lack of key inputs and marketing outlets; and c) sociocultural problems and tenurial arrangements such as insecure rights, caste-related inequities and gender bias.

Attempts made by the developing member countries (DMCs) of the ADB to improve the productivity of these irrigated areas by addressing the constraints specifically have been minimal and largely ineffective. There has been a lack of proactive policies, effective institutions and actions to this end. Additionally, previous irrigation-related research studies focused on general agricultural productivity increases under the overall goal of enhancing food security. While IWMI has pursued the improvement of irrigation systems performance, the research efforts have not gone much beyond technical and physical interventions and general IMT to farmer organizations (FOs) at large. Little scientific knowledge exists on how a range of nontechnical interventions such as economic, financial, institutional and governance measures can most effectively contribute to reducing poverty in these low-productivity areas.

The agriculture sector in the Asian and Pacific region is now facing the dual challenges of increasing food demand and looming water scarcity. Its population is expected to grow from the current 3.0 billion people to over 4.5 billion by 2025. The per capita availability of water in 2025 is estimated between 15 and 35 percent of the levels existing in 1950. It is becoming increasingly difficult to expand irrigated areas, as most accessible water resources have already been developed to capacity in a growing number of river basins. ADB's 1999 rural Asia study showed that the cost of investing in new irrigation schemes has also increased substantially.[1] Moreover, the demand for water for other economic uses is rising fast in association with the rapid economic growth and urbanization in the region, along with the growing pressure to protect the environment. As the single most dominant user of available water resources, irrigated agriculture is facing increasing pressure to produce more food with less water through significant improvements in water use efficiency at the farm and system levels. Low-productivity irrigated areas, in particular, are in stress, as resource-poor farmers in those areas are most vulnerable to water shortages; while there is a significant need to enhance food production there is also a need to ensure food security for the growing population. To meet these challenges, many DMCs in the region are now willing to adopt major policy and institutional reforms toward integrated water resources management at the river-basin level, and improved management of water-delivery services at the individual system level. Such reforms are aimed at optimal allocation of water resources through better coordination of conflicting interests, and improved efficiency and sustainability for individual users.

Under the circumstances, attention should now be focused on improving the productivity of less-productive irrigated areas, while addressing the range of specific poverty-related problems therein. This should be pursued in the context of improving the overall water use efficiency and sustainability of the concerned irrigation schemes. ADB's draft water policy encourages the transfer of management to autonomous and accountable service-delivery agencies with appropriate user representation. The draft policy also emphasizes reducing poverty by ensuring equitable distribution of water in this process, in line with ADB's poverty-reduction strategy. Some DMCs have already initiated programs toward this direction, adopting certain levels of management transfer of irrigation facilities to water user associations (WUAs) and installing financial autonomy and accountability measures. However, there is little evidence that these measures have resulted in more efficient water use. Even less available is the evidence that they have contributed to poverty reduction.

To enhance the livelihood of poor farmers in these areas significantly, while improving the overall performance of irrigation schemes, a more elaborate set of appropriate interventions and their sequencing, along with policies, institutional arrangements and support systems, such as capacity building, should be defined. The interventions should be able to provide necessary incentives and mechanisms for improved equity and reliability of water supply to those areas, ensuring the participation of poor farmers in the decision-making processes of water management. Necessary measures to ensure the sustainability of operation and maintenance (O&M) should also be put in place adopting the user-pay principle while taking into account affordability of the poor. Furthermore, specific interventions should be identified and designed to

[1]The real cost of new irrigation schemes increased by 150 percent in South and Southeast Asia between 1966 and 1988, thus weakening the justification for investing in new irrigation.

address other types of location-specific constraints to poor farmers. This objective can only be pursued through a rigorous assessment of the determinants of poverty in the low-productivity areas, and analysis of the poverty impacts of a range of alternative pro-poor economic, financial, institutional, governance and technical interventions that are available or emerging within the region. Necessary changes in the overall policy and institutional framework should also be assessed to ensure an enabling environment. Given that the managerial and institutional weaknesses largely contribute to the persistent poverty in these areas, the study will pay due attention to a range of nontechnical interventions. These include managerial reforms in WUAs, administration of water rights and water pricing, regulatory and supervisory measures, and other incentives and mechanisms to improve equity while improving system performance.

Goal, Objectives and Scope

The overall goal of the study is to promote and catalyze equitable economic growth in rural areas through pro-poor irrigation interventions in the participating DMCs including Bangladesh, People's Republic of China [PRC], India, Indonesia, Pakistan, and Vietnam. The immediate objective is to determine what can realistically be done to improve the returns to poor farmers in the low-productivity irrigated areas within the context of improving the overall performance and sustainability of the established irrigation schemes.

The study focuses on selected representative low-productivity irrigated areas and their peripheries with a large number of people under persistent poverty in the participating DMCs. The emphasis is on identifying and assessing a set of appropriate economic, financial, institutional, governance and technical interventions at field and system levels, and changes in overall policy and institutional framework as far as they affect access to water resources for the poor. The scope is as follows:

a) analysis and field research on the impacts of the current policy and institutional framework, and the impacts of underlying physical, economic and sociocultural conditions on the selected areas in particular and on the overall irrigation systems at large, including the assessment of opportunities for and constraints on improving productivity in these less-productive areas through improved access to irrigation water; b) identification and in-depth evaluation of a range of potential pro-poor economic, financial, institutional, governance and technical interventions at field and system levels against a set of criteria including cost of implementation and potential to reduce poverty, and assessment of necessary changes in overall policy and institutional framework under which such interventions could most effectively address poverty reduction in the study areas; and c) formulation of a set of appropriate interventions and the policy and institutional frameworks, including adequate support systems, required to ensure large-scale uptake, replicability and higher impacts within and between Asian countries.

Project Components

In line with the study objectives and scope, the study activities were designed to cover the following three aspects:

1. Evaluation of impacts of irrigation on poverty: *analyzing irrigation-poverty linkages*.
2. Assessment of irrigation system performance: *diagnosing causes of existing problems related to irrigation performance*.
3. Assessment of current interventions in irrigation: *learning from innovations*.

The study activities were organized into the following five components:

1. An assessment of poverty in irrigated areas and analyses of linkages between poverty and irrigation: the objective is to improve the understanding of the ways and extent that irrigation can positively contribute to poverty reduction. This component identifies and analyzes key dimensions of the links between access to irrigation water and poverty reduction, and examines any spatial patterns of poverty along the various reaches of the irrigation systems.
2. An assessment of irrigation system performance and associated impacts on poverty: the objective is to improve our understanding of irrigation system performance and to establish and document a thorough knowledge of irrigation performance and management issues and their implications for the poor, specific to the country-study areas.
3. An assessment of institutional interventions and innovations: the objective is to improve the understanding of the current interventions and innovations and their effectiveness to improve system performance, with focus on PIM and irrigation-management transfer, water allocation and rights, and cost recovery and irrigation charging methods.
4. Identification of opportunities and constraints for improving performance of irrigation systems in system-specific study sites: the objective is to help identify specific interventions and innovations that can have strong positive impacts on the improvement of irrigation-system performance and poverty reduction.
5. Development of a menu of the pro-poor interventions.

Research Hypotheses

During a regional conference held in Colombo in August 2001, a lengthy process of consultations culminated in the formulation of the study's research hypotheses (Hussain and Biltonen 2001). These hypotheses were based on dialogues between IWMI researchers, country-research partners, and water and poverty experts. The research hypotheses are:

1. Command areas of specific canal reaches receiving less irrigation water per hectare have lower productivity and a higher incidence of poverty.

2. Under existing conditions, small, marginal and poor farmers receive fewer benefits from irrigation than large and nonpoor farmers.

3. The greater the degree of O&M cost recovery the better the performance of irrigation management and vice versa.

4. Effective implementation of PIM/IMT leads to improved irrigation-system performance that, in turn, reduces poverty.

5. The absence of clearly defined water allocation and distribution procedures, and effective and clear water rights (formal and informal) adversely affects the poor more than the nonpoor.

6. There is scope for improving performance of irrigation systems under existing conditions, with effective and improved institutional arrangements.

Contextual Frame

Regional Poverty at a Glance

The Asian region has deep poverty amid plenty. Over the past three decades, while South East Asia and China have lifted a large proportion of their population out of poverty, South Asia continues to be home to the largest number of the world's poor, estimated at 44 percent of all the poor on the globe. Among the participating six countries of the study, poverty is lowest in China and highest in Bangladesh and Pakistan. China has made remarkable progress in reducing poverty since the late 1970s.From 1978 to 2000, more than 200 million rural poor have been lifted out of poverty, with poverty incidence in 2000 estimated at 3.4 percent in rural areas and less than 2 percent in urban areas. Further, income poverty continues to decline in the country. Such a large reduction in poverty is generally attributed to broad-based economic reforms, which include the adoption of a production responsibility system, dismantling of the commune system, price adjustments of agricultural products and market liberalization, resulting in dramatic rural growth. Likewise, rural infrastructure investments, including investments in irrigation, have significantly contributed to growth and poverty alleviation (Fan et al. 2002).Vietnam also has an impressive record of combating poverty. The estimates for Vietnam show that the incidence of poverty fell from 58 percent to 37 percent between 1993 and 1998, largely attributed to the recent *doi moi* reforms. In 1997, the economies of almost all southeast Asian countries, including Indonesia and Vietnam were adversely affected by the Asian financial crises. In Indonesia, for example, poverty increased from 11 percent in 1996 to 20 percent in 1999. However, since then, poverty appears to have declined considerably, though it is still substantially higher than the pre-crisis period. These countries are getting back on track.

Bangladesh has made good progress over the past decade despite the worst floods; however, over one third of country's population continues to suffer in poverty, and poverty remains one of the serious socioeconomic problems in the country. While estimates vary, around one-third of the population in India continues to live under poverty. The large population size of over a billion, along with historically high inequalities in resource distribution, continuing deprivations of education and basic health, gender issues, class and caste inequities are some of the underlying factors. In Pakistan, the poverty situation has worsened over the past decade, and the estimates suggest that *more than 12 million people were added to the poor in Pakistan between 1993 and 1999. The rising poverty was the result of poor governance and slow economic growth* (Asian Development Bank 2002). All available evidence on poverty trends in Pakistan suggests that the

poverty problem in the country has worsened during the 1990s, and this is more so in rural areas than in urban areas. The rural economy of the country has been caught up in a vicious circle of problems: rapidly increasing population resulting in decreasing per capita resource base, low literacy levels, continuing high level of inequity in resource distribution, slow growth in both farm and nonfarm sectors, and more importantly, continuing poor governance, all these factors adversely affecting the efforts to reduce poverty. Agricultural economy, which forms the backbone of the rural economy of the country has been facing three major interrelated problems: a) increasing water scarcity, b) degradation of land and water resources, and c) low levels of agricultural productivity. Effectiveness and overall impacts of poverty alleviation initiatives begun in the country in 2001 remain to be seen.

A Brief Review of Approaches to the Poverty Problem

Poverty is a complex and multidimensional concept. There is no single indicator that can be used to describe all dimensions of poverty. Different people view poverty in different ways. The worst kind of poverty is when people do not have access to basic food and water to fulfill their basic physical needs and, therefore, they are undernourished, weak and are susceptible to diseases. Another kind of poverty is where people may have more or less enough food but do not have access to other basic needs such as adequate water for sanitation, health services, clothes and housing. Traditionally, poverty has been viewed in terms of minimal incomes or consumption to meet basic human needs, usually defined in terms of a) absolute poverty: minimum consumption needs without reference to income or consumption levels of general population, and b) relative poverty: individual's consumption with reference to average income or consumption of the population. However, it has been argued that the traditional concept of poverty in terms of incomes or consumption is too narrow and is not an adequate measure of poverty and that other nonmonetary aspects of deprivation are also important.

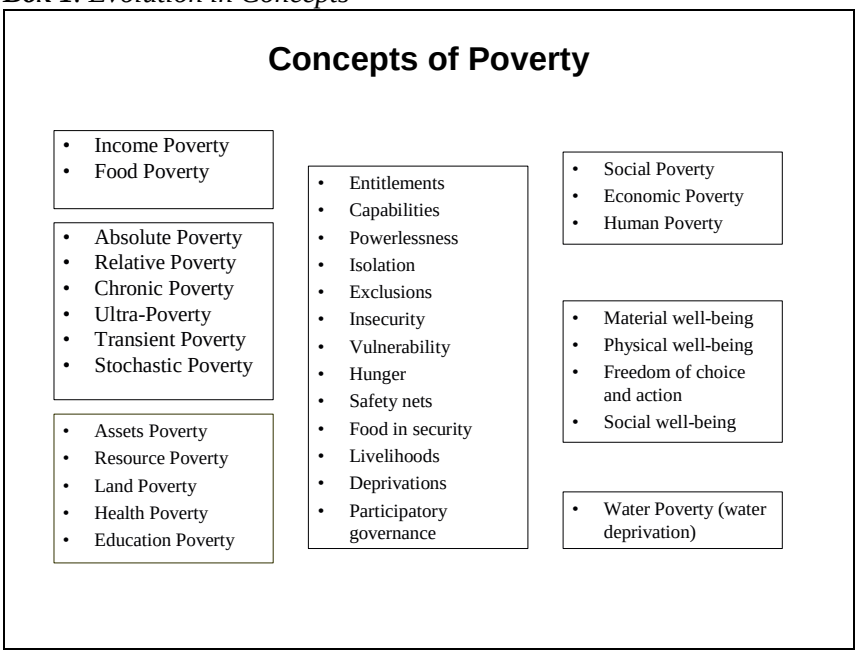
An enormous amount of research work has been carried out to understand the poverty problem and its causes over the past three decades. The box below outlines various concepts of poverty evolved over time. One of the key lessons learnt from the past work is that poverty is complex and multidimensional, and it is the result of myriad interactions across and between resources, technologies, institutions, strategies and actions at various levels, and that there is no single solution to this problem. It is now being increasingly recognized that hunger and malnutrition, insecurity, vulnerability and powerlessness are only symptoms of poverty; and that poverty is not only caused by lack of access to resources, opportunities, information, technologies and other socioeconomic and demographic factors but it is an outcome of much deep-rooted factors, such as global- level policies and actions, national-level historical factors, resource-distribution patterns and initial conditions, and government policies, institutions and actions at various levels, community-level informal institutions, power structures and actions.

However, while looking at poverty from both economic and noneconomic dimensions and from the global to local levels provides a fairly comprehensive approach to understanding poverty, analytical and measurement problems pose difficulties in the application of most of these concepts. Consequently, much of the empirical work on poverty at various levels relies on traditional income and consumption measures.

While poverty is still often measured, accounted for and understood in material terms, several approaches have been proposed to account for nonmaterial dimensions of poverty. Some of the major approaches to understanding and addressing poverty include the following:

The UNDP has developed a "Human Poverty Index," which views poverty as a lack of basic human capabilities. The index consists of five key indicators: life expectancy, access to safe water and to health services, literacy and the proportion of children underweight aged five and under. Income poverty is also emphasized, with extreme poverty defined as the lack of income to satisfy basic food needs and overall poverty as the lack of income to satisfy a range of basic needs including food, shelter, energy and others.

Box 1. *Evolution in Concepts*



The Asian Development Bank's poverty reduction strategy of 1999 defines poverty as deprivation of essential assets and opportunities, poor access to education and health services, vulnerability to external shocks and exclusion from key decisions that affect their lives. The strategy is based on three core areas: sustainable economic growth, inclusive social development and improved governance at policy and institutional levels. Governance, gender and environmental sustainability are recognized as key elements of the strategy. ADB (1999) has recently developed a framework of actions for reducing poverty through water interventions, and the six key areas of action are identified as: a) pro-poor water governance, b) improved access to quality water services, c) improvements to livelihoods and pro-poor economic growth, d) community capacity building and empowerment, e) disaster prevention and mitigation, f) good governance, and g) ecosystems management.

The World Banks in its *World Development Report 2000* emphasizes on *dynamic and multidimensional characters of poverty*. The Bank's approach recognizes both material and nonmaterial dimensions of poverty. Key aspects of poverty are given as the inability to satisfy basic needs, lack of control over resources, lack of education and skills, poor health, malnutrition,

lack of shelter and access to water supply and sanitation, vulnerability to shocks and a lack of political freedom and voice.

The DFID's *"Sustainable Livilihoods Approach" (SLA)* recognizes livelihoods as comprising capabilities, assets including both material and social resources and activities required for means of living. The approach recognizes that poverty is multidimensional and emphasizes that poverty reflects poor access to livelihood assets (natural, social, human, financial and physical capital in the DFID model) and vulnerability to external shocks and trends in society. Core objectives of the SLA approach are to promote: a) improved access to high-quality education, information, technologies and training and better nutrition and health; b) a more supportive and cohesive social environment; c) more secure access to, and better management of, natural resources; d) better access to basic and facilitating infrastructure; e) more secure access to financial resources; and f) a policy and institutional environment that supports multiple livelihood strategies and promotes equitable access to competitive markets for all.

The OECD's *Poverty Guidelines 2001* emphasizes that poverty, gender and environment are mutually reinforcing, complementary and crosscutting facets of sustainable development. Poverty has been recognized as being rooted in the lack of economic, human, political, sociocultural and protective capabilities.

The recent *Dutch Poverty Reduction Policy* stresses the complex and multidimensional character of poverty, including both material and nonmaterial dimensions of poverty. Understanding poverty, and gender and environmental issues is a key element of the policy. The links between local, national and international processes that cause poverty and the roles of different actors in addressing poverty are stressed. Pro-poor growth and good governance are recognized as key to addressing the poverty issues.

The international forums such as *World Summit on Sustainable Development*, linking poverty and environmental management, emphasize the material and non-material aspects of poverty including the lack of income and material means, poor's access to services, poor's physical security and the lack of empowerment to engage in political processes and decisions that affect one's life.They focus on livelihoods, health and vulnerability as three dimensions of poverty reduction.

While acknowledging the importance of global-level factors and nonmaterial dimensions of poverty, this study focuses mainly on national- and local-level factors and on material dimension of poverty and does not address other dimensions of poverty, such as health poverty, physiological poverty and brain poverty. While the household is an important basic unit for analysis of poverty, the study does not analyze or address intra-household factors related to poverty.

Defining the Concept: "Pro-poor" Intervention

In the 1990s, there was renewed interest in poverty-reducing growth issues, with increasing recognition that high rates of growth alone will not be sufficient for rapid poverty reduction.

These issues have become important in relation to growing concerns over continuing existence of high inequalities in resource distribution and opportunities, lack of an explicit focus of most poverty-reduction strategies to address equity issues, and even more so in relation to Millennium Development Goals (MDGs), which aim to reduce by half the proportion of the number of people suffering from extreme poverty and hunger by 2015. The renewed emphasis on poverty reduction has generated new terms such as "pro-poor growth," "pro-poor spending," "pro-poor strategies and approaches," and "pro-poor interventions," which have become popular in development discussions. The central idea in all these terms is that higher average incomes and an overall high growth rate alone are not sufficient; it is the high quality growth that enables the poor to participate in, contribute to and significantly benefit from, economic activities and opportunities, which will have significant impacts on poverty reduction. Technical debates were initiated in the late 1990s on how to measure the pro-poor growth, and various definitions and descriptions of the terms have emerged in the literature. The terms have been defined and described variously by development experts and organizations; however, there are no agreed definitions and no clear consensus regarding their precise meaning. Box 1 provides a brief review of various definitions and descriptions, and a clarification is made here on how the concept of "pro-poor intervention" is applied in this study.

The definitions and terms reviewed from the recent literature emphasize on three aspects in relation to growth process and related approaches and interventions to qualify as pro-poor as when:

a) Benefits to the poor are immediate, significant, greater than their current benefits, and greater than the average level of benefits to the society as a whole; and to the nonpoor, overall socioeconomic indicators of the poor improve faster than those of the nonpoor.

b) Policies, institutions, programs and interventions explicitly focus on significantly reducing inequalities in incomes, resources and opportunities in favor of the poor, remove institutional and policy-induced biases against the poor, or are deliberately biased in favor of the poor so that the poor benefit disproportionally more, create assets for the poor and create enabling environment for them to participate in economic activities.

c) When it involves focusing, favoring and targeting the poor in terms of better utilization of factors of production the poor own (such as labor) in terms of spending and investment in the sectors they work in (such as agriculture), and in areas and localities they live in (poor communities in rural settings) and the outputs which they produce and consume (such as food).

As is clear from various definitions and interpretations in Box 1 some emphasize benefits and impacts of growth on the poor in relative terms while others do so in absolute terms. Also, notice that indices for measuring pro-poor growth focus on income criteria and ignore other important qualitative dimensions of poverty, basically due to measurement complexities in the case of the latter.

Box 2.

A. Definitions and interpretations: "Pro-poor" growth and approaches

Asian Development Bank (1999): "Growth is pro-poor when it is labor-absorbing, and accompanied by policies and programs that mitigate inequalities and facilitate income and employment generation for the poor, particularly women and other traditionally excluded groups."

World Bank (2000), UN (2000) and OECD (2001): "Growth that results in significant poverty reduction, thereby benefiting the poor and improving their access to opportunities." Other interpretations by the Word Bank—" Efficient labor-intensive growth based on appropriate market incentives, physical infrastructure, institutions and technological innovations"; and UNDP—"Economic growth contributes most to poverty reduction when it expands the employment, productivity and wages of poor people and when public resources are spent to promote human development."

DFID"Pro-poor growth is one which should include the poor by maximizing their opportunities and by utilizing their skills, time and physical resources." It is also related to the productive usage of the assets of the poor and opening up of access to markets.

Kakwani and Pernia (2000) and Pernia (2003): " Pro-poor growth is the type of growth that enables the poor to actively participate in economic activity and benefit proportionally more than the nonpoor from overall income increases." Pro-poor growth requires that the proportional income growth of the poor exceed the overall average income growth. Pro-poor growth is predicated on policies that are deliberately biased so that the poor benefit disproportionally. It also involves the removal of institutional and policy-induced biases against the poor. Pro-poor growth is a critical element in poverty reduction as it factors in the distributional dimension.

Vandemoortele (2003): "Growth is pro-poor, if it uses the assets the poor own, if it favors the sectors where the poor work, and if it occurs in areas where the poor live". Pro-poor policies imply that the social and economic indicators for poor people improve faster than those for the rest of society.

Ravallion and Datt (2002) define pro-poor growth as one with high elasticity of poverty with growth.

Scott (2002): "Growth is pro-poor if the correlation coefficient between growth and change in poverty is negative, high in absolute value and statistically significant."

Eastwood and Lipton (2001) suggest that making growth more pro-poor in early development equals mainly a) achieving labor-intensive growth in the production of food staples, especially by technical production and high rate of growth in agriculture; b) enhancing this impact of cheaper food and higher demand for rural labor by stimulating small-scale farms via land distribution and land redistribution; and c) increasing incentives to reduce fertility, mainly lower child mortality, more and better female education and work options, and probably family planning information, and spreading them to the poor.

Klasen (2001) identifies pro-poor growth as "growth that disproportionately benefits the poor, i.e., the proportional income growth arte of the poor must exceed the average income growth rate."

Dollar and Kraay (2000):"Growth is pro-poor when mean income of the poorest 20 percent rises proportionately as fast as mean income of the whole distribution."

White and Anderson (2000) offer three definitions of pro-poor growth:

1. The poor's share of incremental income exceeds their current share, i.e., growth increases poor's share of income. Suppose the initial share of the bottom 20 percent is 6 percent and that of the top 20 percent is 35 percent, and if 7 cents of a dollar's worth of growth goes to the poor and 34 cents to the rich, this is pro-poor growth. If the initial share of the bottom 20 percent was 8 percent, and they get 7 cents from each dollar of growth, then this is anti-poor growth.
2. The poor's share of incremental income exceeds their share of the population. This is equivalent to the condition that the gap between the mean income of the poor and overall income must close. This basically means that growth that does not qualify as pro-poor may cause a widening of the gap between the incomes of the poor and the nonpoor.
3. The poor's share of incremental income exceeds some international norm. This requires identification of an "international norm,"e.g., median income shares of the bottom 20 and 40 percent – 5.6 percent and 16.7 percent, respectively.

B. Indices for Measuring Pro-poor Growth:

1. *Kakwani and Pernia (2000)* and *Pernia (2003):* "Pro-poor growth index" is the ratio of the actual observed poverty elasticity (total change in poverty) and the poverty elasticity explained by growth. It emphasizes the decomposition of poverty changes into a growth and a distribution component.
2. *Kakwani et al. (2003):* "Poverty equivalent growth rate." This is based on the above "pro-poor growth index."
3. Ravallion and Chen "Pro-poor growth" is the mean growth rate of the poor (the base year poor) and the index measures how growth reduces poverty by some agreed poverty measure.

For the practical and applied purposes for this study, a pro-poor intervention in irrigated agriculture—policy, institutional, managerial, legal or regulatory, financial, economic, infrastructural or technological—is defined as one which leads to improvements in agricultural productivity; returns to factors of production such as land and labor; returns to farming; employment and wages; incomes and expenditures and overall livelihoods; and which generates assets and opportunities for the poor to participate in socioeconomic activities for their welfare, and have significant impacts on poverty reduction. Further, an intervention may be regarded as:

a) *Strongly pro-poor,* where the poor's share in positive incremental impacts/benefits of an intervention, such as improvements in the above indicators, is significantly greater than their current share and also greater than the share of the nonpoor.

b) *Pro-poor,* where the poor's share in positive incremental impacts/benefits of an intervention, such as improvements in the above indicators, is greater than their current share.

c) *Neutral,* where the poor's share in positive incremental impacts/benefits of an intervention, such as improvements in the above indicators, is equal to their current share.

d) *Anti-poor,* where the poor's share in positive incremental impacts/benefits of an intervention, such as improvements in the above indicators, is less than their current share or the poor's share in negative incremental impacts/dis-benefits of an intervention is greater than their current share.

Distinct Features of This Study

Unlike conventional research studies in issues related to irrigation and poverty, this study is unique and has several distinct features in terms of geographical coverage, scope of issues, analytical rigor, consistency in approaches and methods, quantity, quality and reliability of data and information, local and global stakeholder participation and partnerships, awareness and communication, and most importantly in terms of timeliness, and relevancy of issues and questions addressed and the interventions proposed. Some of these features are highlighted below.

Geographical coverage. The study covers six Asian countries which together account for over 73 percent of irrigated areas in the Asian region, covering 26 systems and their peripheral areas representing medium- and large-scale systems and rain-fed areas in these countries. Findings, conclusions and lessons learnt from these systems are of generic value for other systems in the study countries.

Scope of issues. The study takes a holistic approach in studying a range of issues related to irrigation and poverty in irrigated agriculture, exploring the magnitude, causes and patterns of poverty, characteristics of the poor, irrigation-poverty linkages and impacts, irrigation performance and poverty linkages, irrigation financing and service charging and their implications for the poor, irrigation policies and institutional reforms and their implications for the poor, and pro-poor approaches and interventions in irrigated agriculture.

Consistency in approaches and methods, and analytical rigor. The study adopts consistent procedures, tools and methods across countries and systems for meaningful comparisons. The study employs both qualitative and quantitative approaches to analyses. Where necessary, the study employs rigorous quantitative techniques of analyses and estimations.

Quantity, quality and reliability of data and information. The study, while making use of available good-quality secondary information and data, relies mainly on field-level primary data and information based on measurements, formal and informal discussions with a range of field-level managers, officials, local leaders and detailed surveys of 5,408 farmers. Data and information used for analyses is reliable, and findings and conclusions of the study reflect "ground realities."

Local and global stakeholder participation and partnerships. The study involved a large number of stakeholders, both men and women, at all stages of study implementation including at the research planning stage (in identifying the research issues, developing research questions and hypotheses, and developing an overall work plan), at the research implementation stage (in carrying out study activities), and at the research conclusion stage. The stakeholders included key donor agencies, internationals researchers and experts, representatives from the academic community and NGOs, national-level politicians, journalists, national-level policymakers, local-level mangers and officials, and farmers. The study implementation was done through collaboration with national-level research and development partners.

Awareness and communication. The study successfully raised awareness of the issues at various levels through a range of communication and awareness-raising tools. These include presentations at global-level fora [such as World Summit on Sustainable Development in Johannesburg, South Asian Water Forum in Islamabad, ADB's Dhaka Meeting on Water and Poverty, 3rd World Water Forum in Kyoto, 1st and 2nd ADB Water weeks in Manila, Global Water Partnership Consultation Meeting in Colombo, and International Conference of Environmental Journalists in Colombo], holding regional- level workshop in Colombo, holding national-level workshops in each of the participating countries (12 workshops, 2 in each country), through media coverage (briefs, newspaper articles and news), through publishing of a range of scientific publications, and through development of a project website.

Timeliness and relevance of issues and questions addressed and solutions proposed. Research in the study is of an applied nature with a focus on realistic solutions and actions. The study findings, conclusions and outputs are timely and can provide useful inputs in developing and strengthening poverty-reduction strategies and water sector policies, institutions and reforms that are currently underway to solve water-sector problems and fight against poverty.

Organization of the Project Research Outputs

As mentioned earlier, IWMI and the partners produced a significant number of intermediate and final outputs during the project period. These included an inventory of issues related to water and poverty in irrigated agriculture in the region; an inventory of global literature on water and

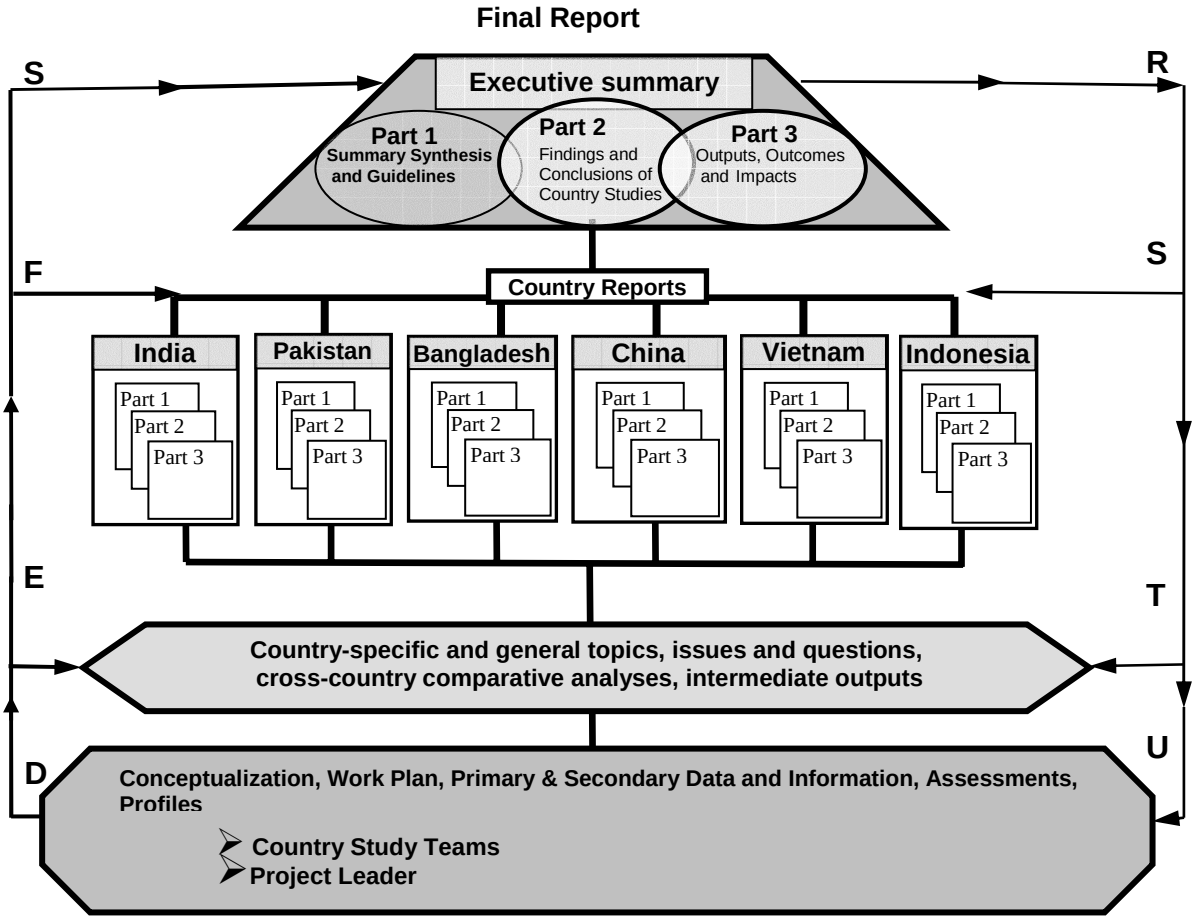
poverty in agriculture; documentation of the current situation and problems related to irrigation-system performance, productivity and poverty in the selected systems; irrigation-poverty profiles for study countries covering a variety of aspects at macro, meso and micro-levels; and a database consisting of primary and secondary data; cross-country comparative analyses; and a set of pro-poor interventions, actions and implementation strategies and guidelines. These outputs are documented in a variety of forms including published and unpublished reports, journal articles, working papers, conference papers, workshop proceedings, newspaper briefs and other forms. The process of output development, its management and organization are depicted in figure 1.1.

Points D to S on the left hand side show various stages of output production and linkages across various outputs (for developers), where the first step shown by point D indicates conceptualization of the problems and issues and development of the work plan, data and information collection and preliminary assessments of irrigation and poverty, feeding into the second step shown by point E indicating further refinements of the general and country-specific issues and the production of intermediate outputs including cross-system comparative analyses, leading to the third step shown by point F indicating development of final outputs for each of the six countries; and the final step shown by point S indicating production of final outputs based on outputs produced at all three stages D, E and F.

Points R to U on the right hand side show organization and presentation of various research outputs (for readers and users); the outputs are organized so that there is consistency in presentation, and importantly, to accommodate readers with varying degrees of time availability, interest and expertise in specific issues, methods and locations. Readers and users interested in overall project conclusions and guidelines may refer to the final report, which provides a summary and synthesis of main findings and conclusions and which offers pro-poor intervention strategies and guidelines based on lessons learnt from the country studies. With an executive summary, the final report is organized into three parts. Part I presents the study background, summary and synthesis of main findings, conclusions and generic lessons learnt based on cross-system and cross-country comparative analyses, and guidelines for all the participating countries. Part II of the report provides summaries, findings, conclusions and recommendations for each of the six countries separately, with each country summary further divided into three subsections: historical and contextual frame, study settings and data, and a summary of main findings and conclusions. Part III of the report provide details on study implementation arrangements and activities, study outputs, capacity development, presentation and dissemination of study findings, awareness and media coverage, stakeholder participation, partnerships, study impacts and outcomes.

Readers and users interested in more detailed issues in specific countries/locations may refer to a country report, where for consistency and comparison purposes each report is organized into three main parts: a) overview of poverty and irrigation, b) institutional arrangements for irrigation management, and c) an analysis for strategic pro-poor interventions, followed by a summary and conclusions. Readers and users interested in more detailed cross-country comparative analyses of specific issues may refer to issue papers (point T), and those interested in further details and would like to have discussions on any aspect of the project may contact the project leader or the study team leaders (point U).

Figure 1.1. Organization of research outputs.



Organization of the Report

This report is organized into three parts. Part I presents the study background, a summary and synthesis of main findings, conclusions and generic lessons learnt based on cross-system and cross-country comparative analyses. This part is divided into four chapters: 1) study background, 2) study setting, data and methods; 3) summary and synthesis of findings, and 4) conclusions and pro-poor intervention strategies. Each chapter consists of a number of sections. Chapter 1 summarizes background material about the study including study goals, objectives, scope, components, research hypotheses, concept of pro-poor intervention, broad approaches to rural-poverty alleviation, distinct features of the study and organization of the project research output. Chapter 2 describes study settings, main features of the selected irrigation systems, and data and information collection procedures and methods. Chapter 3 offers a summary and synthesis of main findings and conclusions based on comparative analyses, and is organized into six sections: a) Inequity and poverty in irrigation systems: magnitude, causes and patterns, b) Impacts of irrigation on poverty alleviation; c) Irrigation system performance and poverty linkages, d)

Irrigation service charging: implications for the poor, e) Irrigation sector reforms: implications for the poor, and f) Other major findings. Each subsection of these sections highlights the key points followed by a paragraph or two summarizing the main points. Chapter 4 synthesizes the main conclusions and pro-poor intervention strategies and guidelines.

Part II of the report provides summaries, findings, conclusions and recommendations for each of the six country studies. These are based on draft reports for country studies and inputs from national workshops in each of the six countries. This part is organized into six sections, one for each country. Countries have been organized by regions (South Asia, China and Southeast Asia) and by geographic/population size of a country as: India, Pakistan, Bangladesh, China, Indonesia and Vietnam or it could have been done alphabetically by country name (we preferred the first option). In each section, the summary of a country study is organized into three subsections: the first section provides background on irrigation and poverty, the second section outlines characteristics of study settings, data collection and study methods, and the third section presents main findings, conclusions and recommendations.

Part III of the report provide details on study implementation arrangements and activities, study outputs, capacity development, presentation and dissemination of study findings, awareness and media coverage, stakeholder participation, partnerships, study impacts and outcomes.

Chapter 2

Study Settings, Data and Methods

This chapter provides a brief description of the study areas and outlines salient features of the settings and irrigation systems selected for the study, including a very brief description of data collection methods and approaches employed in the study. More description on study settings and data collection procedures for each country are presented in part II of this report and further details for each system are presented in the country study reports.

The study participating countries: Bangladesh, China, India, Indonesia, Pakistan and Vietnam are among the top few countries where substantial investments have been made in the development of large- and medium-scale canal irrigation systems, and where irrigated agriculture provides livelihoods to hundreds of millions of rural people. According to recent statistics, these countries together account for over 51 percent of the global net irrigated area and over 73 percent of net irrigated areas in Asia, with most of this area located in China, India and Pakistan (table 2.1).

Table 2.1 Net irrigated areas ('000 ha) in the study countries, 2001.

	Net irrigated area ('000 ha)	World net irrigated area (%)	All-Asia net irrigated area (%)
World	273,052		
All-Asia	190,385	69.7	
- Bangladesh	4,421	1.6	2.3
- India	54,800	20.1	28.8
- Pakistan	17,820	6.5	9.4
- China	54,831	20.1	28.8
- Indonesia	4,815	1.8	2.5
- Vietnam	3,000	1.1	1.6
Total	139,687	51.2	73.4

NIA = Net irrigated area (NIA) defined by the FAO as area developed using appropriate methods to irrigate crop fields. NIA includes areas with partial control irrigation, spate irrigation areas, and equipped wetland or inland valley bottoms.

Source: Based on data set from FAO 2001.

In this project, 26 irrigation systems and their peripheral rain-fed areas were selected from the six countries. The selected systems represent medium- and large-scale canal systems in the respective countries. Locations of the systems are shown in figure 2.1. Ganges Kobadak and Pabna systems are located in the southwestern and west-central parts of Bangladesh, along the Ganges and Brahmaputra rivers, respectively. Nagarjuna Sagar and Krishna delta systems are located in Andhra Pradesh along upstream and downstream, respectively, of the Krishna river. Halali and Harsi systems are located along Halali and Parvati rivers in the Vidisha and Gwalior districts, respectively, in Madhya Pradesh. The selected systems in Pakistan are located in the upper Indus basin. In China, Weining and Qingtongxia systems are located in the northeastern province of Ningxia along upstream of the Yellow river, and People's Victory and Liuyuankou systems are

located in the eastern province of Henan along downstream of the Yellow river. In Vietnam, Nam Duong and Namthach Han systems are located in the Red river Delta region and North Central Coastal region, respectively. In Indonesia, selected systems are located in Central Java and Yogyakarta provinces.

Figure 2.1 Study locations.

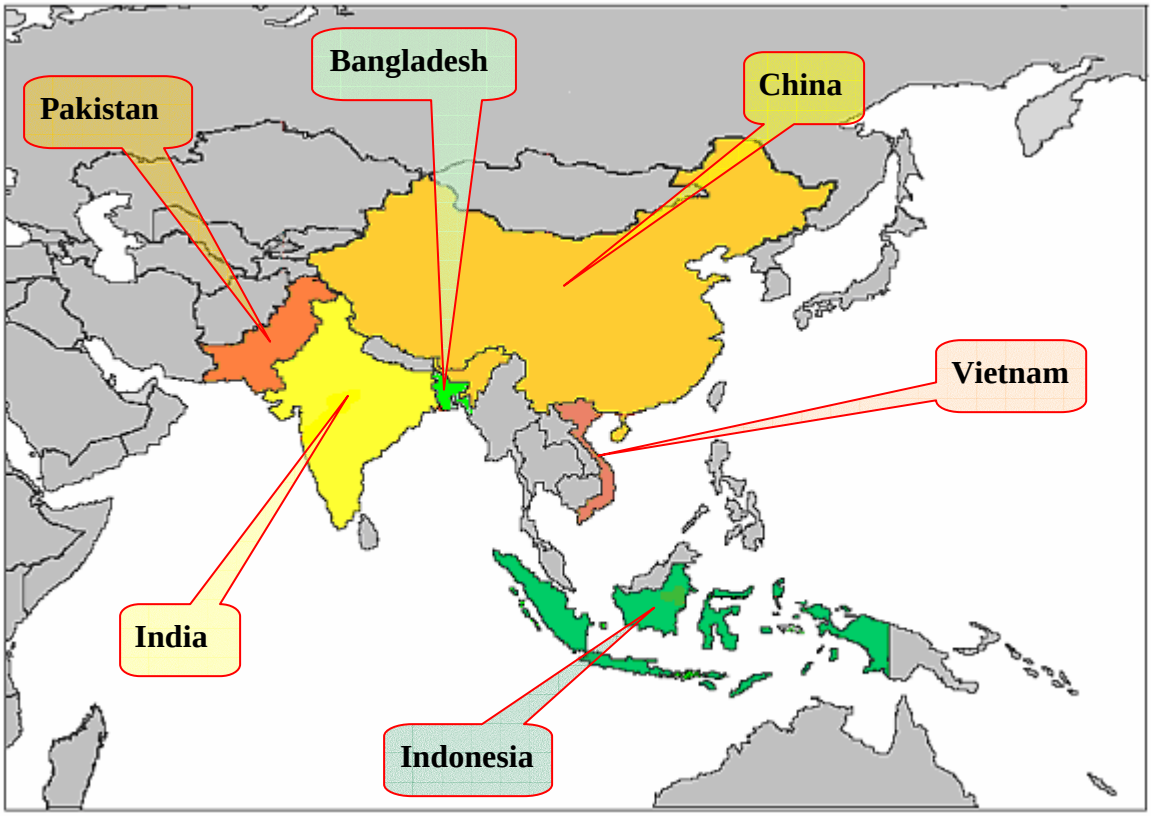


Table 2.2 outlines key characteristics of the selected systems. The selected systems vary in terms of size, canal water supplies, groundwater use, condition of irrigation infrastructure, irrigation-management patterns, crop productivity, level of crop diversification, land quality and size of landholdings. Some systems in China and Pakistan are very old. Systems vary in size/command area from 813 to 21,475 hectares in Indonesia and from 23,500 to 50,8000 hectares in India. In general, the selected systems in South Asia and China are much larger than those in Southeast Asia. The selected systems fall in regions with varying degrees of rainfall. Rainfall is lowest in selected systems in China and Pakistan ranging from 200 to 650 mm, moderate in selected systems in India from 750 to 1,050 mm, and high in selected systems in Bangladesh, Indonesia and Vietnam of over 1,500 mm. Cropping patterns in low and high rainfall areas are dominated by wheat and rice cultivation, respectively. Rice-wheat rotations are commonly practiced in Chinese and Pakistani systems. In other systems, rotations of rice, pulses and other high-value crops are common. The level of crop diversification varies from one system to another and depends on a range of factors, such as soil quality, cultivation practices, market infrastructure and most importantly on the availability of water from rainfall, and surface water and groundwater sources. Out of 26 selected systems, surface water is the only or major source of water supplies

for crop production in 11 systems. In other systems, conjunctive use of surface water and groundwater is common; this is especially so in the selected systems in South Asia.

The study used both secondary data and field-level primary data and information, and employed qualitative and quantitative approaches to analyses. Secondary data were obtained from a variety of sources including government publications, donor reports, other published and unpublished sources. However, the primary data collected from the field provided a major source of analyses for the country studies. IWMI in collaboration with national partners developed a variety of tools for primary data and information collection, such as field-level focus group discussions, participatory rapid appraisals and household-level questionnaire surveys. For household-level surveys, consistent procedures were adopted for developing a sampling framework and for sample selection across selected systems in six countries. For each irrigation system, samples were drawn using a multistage stratified-cluster sampling method. In the first stage, each selected system was purposively divided into three strata, e.g., head, middle and tail parts. The stratification helped in classifying a system into smaller areas that are homogenous in terms of cropping patterns, access to water and irrigation infrastructure. In stage two, each of the strata was divided into a number of clusters (in irrigated and rain-fed areas, a distributary canal and a village, respectively, was defined as a cluster). One to two representative clusters were selected along each of three reaches at head, middle and tail of a system. Stratified-cluster sampling helped in obtaining smaller but more representative samples and facilitated implementation of surveys over wider geographical areas. In stage three, a sample of households was selected from each cluster. At this stage, a complete sampling frame, i.e., a list of all households for each of the selected representative clusters was developed. A systematic random sampling was used to draw sample households from the sample frame. Given the variations in size of the selected systems, some strata and some clusters within a stratum were larger than others. The general rule adopted was that the smaller the variation in parameters of interest across clusters in a stratum, and households in a cluster, the smaller the sample size of selected clusters and households, and vice versa. If there were no significant intra-stratum and intra-cluster variations in the parameters of interest, an equal allocation method was applied, i.e., an equal number of clusters from each stratum and an equal number of households from each cluster were selected, regardless of the size of a stratum/cluster. Given the differences and complexity of systems across countries, there were some minor variations in procedures adopted according to local conditions, but overall sampling procedures were fairly consistent across systems.

The total survey sample size was 5,408 households in 26 selected systems. The distribution of sample size across systems and countries is shown in table 2.2 (last column). For each country, the sample size was as follows: Bangladesh – 900; India –1092; Pakistan – 1224; China -231 [in addition, a sample size of 1,199 households from six provinces, namely Hebei, Liaoning, Shananxi, Zhejiang, Hubei and Sichuan was also used in the study); Vietnam – 960; and Indonesia – 1,001 households. The selected households were interviewed with a pre-tested, structured questionnaire to gather information on various aspects of household economies including demographics, landholdings and agriculture, irrigation, costs and returns of crop cultivation, household assets, employment and earnings from the non-agricultural sector, credit, household total incomes and expenditures and other related variables. The survey covered all cropping seasons during the 2001-2002 agricultural year.

Table 2.2 Salient features of the selected irrigation systems.

Country	System name	Location	Construction date	Management type	Size (ha)	Annual rainfall (mm)	Major crops	Source of water	Water-availability	Sample size
Bangladesh	G-K	South-western Bangladesh	1969	Agency	142,000	1,500	Rice, pulses, oilseeds, tobacco	Both SW and GW	Water- short	400
	Pabna	West-central Bangladesh	1992	Agency	145,300	1,900	Rice, pulses, vegetables	Both SW and GW	Water-adequate	400
India	NSLC	Andhra Pradesh/Krishnia river- Upstream	1955	Transferred	246,000	750	Rice-groundnut	Mainly SW	Water- short	300
	KDS	Andhra Pradesh/ Krishnia river-Downstream	1852	Transferred	508,000	900	Rice, pulses, vegetables	Mainly SW	Water-adequate	240
	Halali	Madhya Pradesh	1973	Transferred	23,500	1,050	Wheat, soybean, pulses	SW	Water- short	217
	Harsi	Madhya Pradesh	1925	Transferred	41,500	850	Wheat, rice, gram	Both SW and GW	Water- short	205
Pakistan	9-R	Upper Jehlum canal	1915	Agency	5,950	644	Rice-Wheat	Both SW and GW	Water- short	90
	10-R	Upper Jehlum canal	1915	Agency	4,370	644	Rice-Wheat	Both SW and GW	Water- short	90
	13-R	Upper Jehlum canal	1915	Agency	2,870	644	Rice-Wheat	Both SW and GW	Water- short	90
	14-R	Upper Jehlum canal	1915	Agency	22,180	644	Rice-Wheat	Both SW and GW	Water- short	90
	Kakowal	Upper Jehlum canal	1915	Agency	9,270	644	Mixed-wheat	Both SW and GW	Water- short	90
	Phalia	Upper Jehlum canal	1915	Agency	26,910	644	Mixed-wheat	Both SW and GW	Water- short	90
	Lalian	Lower Jehlum canal	1901	Agency	44,480	413	Mixed-wheat	Both SW and GW	Water- short	171
	Khadir	Lower Jehlum canal	1901	Agency	47,430	413	Mixed-wheat	Both SW and GW	Water- short	171
	Khikhi	Lower Chenab canal	1892	Agency	32,940	372	Mixed-wheat	Both SW and GW	Water- short	171
	Hakra-4	Hakra System	1937	Transferred Village Cooperatives	17,850	196	Cotton-wheat	Both SW and GW	Water- short	171

Table Contd.

Table 2.2 (contd.)

Country	System name	Location	Construction date	Management type	Size (ha)	Annual rainfall (mm)	Major crops	Source of water	Water-availability	Sample size
	QID-NP	Ningxia Province-Northwestern China upper YRB	B.C	Village Cooperatives	304,000	195	Wheat-Rice-Maize-Other	SW	Water- short	95
	PID-HP	Henan Province-Eastern China Lower YRB	1952	Village Cooperatives	99,000	620	Wheat-Rice-Maize-Other	Both SW and GW	Water- short	66
	LID-HP	Henan Province-Eastern China Lower YRB	1967	Village Cooperatives, IDMCs	31,000	639	Wheat-Rice-Maize-Other	Both SW and GW	Water- short	36
Vietnam	Nam Duang	Red river Delta	1962	Village Cooperatives, IDMCs	16,775	1,700	Rice and upland crops	Mainly SW	Water- short	480
	Nam Thach Han	North Central Region	1978	Agency	7,657	2,609	Rice	Mainly SW	Water-adequate	480
Indonesia	Klambu Kiri	Central Java	1987	Agency	21,475	2,092	Rice, mungbean, soybean	SW	Water- short	300
	Glapan	Central Java	1930	Transferred	18,284	2,458	Rice, mungbean	Mainly SW	Water- -short	250
	Kalibawang	Yogyakarta	1940	Transferred	6,454	2,291	Rice, vegetables	Mainly SW	Water-adequate	250
	Krogowanan	Central Java	1976		813	2,065	Rice, soybean, maize, vegetables	SW	Water-abundant	101

Notes: IDMCs: Irrigation and Drainage Management Companies; G-K = Ganges Kobadak; NSLC = Nagarjuna Sagar Left Bank canal; KDS = Krishna Delta Systems; WID-NP =Weining Irrigation District in Ningxia province; QID-NP = Qingtongxia irrigation district in Ningxia Province; PID-HP = People's Victory Irrigation District in Henan province; LID-HP = Liuyuankou Irrigation District in Henan province. SW = Surface Water; GW = Groundwater.

The study employed both qualitative and quantitative approaches to analyses. Details on key approaches, methods, techniques and indicators for measuring household incomes and expenditures, poverty incidence, depth and severity, impacts of irrigation on poverty, performance of irrigation and its linkages with poverty, assessment and effectiveness of interventions in irrigated agriculture and related aspects are given in the study work plan document and draft final report for each of the participating countries.

Chapter 3

Summary and Synthesis of Findings and Conclusions

This chapter provides a summary and synthesis of main findings and conclusions from the country studies. Summaries of main findings and conclusions for each of the six countries are given in part II of this report, and detailed analyses, findings and conclusions for each country are presented in the respective country study reports. In line with study components, described in chapter 1, presentation of findings and conclusions in this chapter are organized into the following six sections:

- Inequity and poverty in irrigation systems: Magnitude, causes and patterns.
- Impacts of irrigation on poverty alleviation.
- Irrigation system performance and poverty linkages.
- Irrigation service charging: implications for the poor.
- Irrigation sector reforms: implications for the poor.
- Other major findings.

A. Inequity and Poverty in Irrigation Systems: Magnitude, Causes and Patterns

1. Inequity in land distribution is highest in Pakistan systems and lowest in Chinese systems

Average landholding size per household in selected systems varies from 0.25 hectare (Indonesia) to 6.54 hectares (Pakistan). Landholdings are of much smaller size in selected systems in Southeast Asia (SSSEA) than in selected systems in South Asia (SSSA). Across SSSEA,[2] the majority of households own holdings less than 1 hectare, with those in Vietnam owning less than 0.5 hectare. Among SSSA, landholding size is the lowest in Bangladesh (average less than 1 hectare) and highest in Pakistan (2.49 to 6.54 hectares). While average landholding size is higher in SSSA, its distribution is highly inequitable with the highest inequity in Pakistan followed by Bangladesh. In Pakistan, 75 percent of sample households owned around 40 percent of land, and 25 percent owned 60 percent of land. Gini coefficient for land across selected systems in Pakistan varies from 0.31 to 0.56, with an average value of 0.49. In Bangladesh (G-K system), the lower 71 percent of sample households owned 25 percent of land, the middle 27 percent owned 32 percent of land, and the upper 2 percent owned 43 percent of the total land, indicating a significant inequity in land distribution.

2. Equity (rather over-equity) in land distribution is a key feature of agricultural economies in China and Vietnam

Across SSSEA, though average landholding size per household is very small its distribution is fairly equitable except in some systems in Indonesia. Unlike South Asia, equity in land distribution is a typical characteristic of agricultural economies of China

[2] Geographically China lies in East Asia. In this report, China is included in the South East Asia region, for the sake of convenience in interpretation.

and Vietnam. Our study in China shows that the size of farms in terms of cultivated area is very similar among various income groups and between the poor and the nonpoor. Such an equitable distribution of land, an outcome of equity policies adopted in these countries, has played an important equity-increasing and poverty-reducing role in rural economies of these countries (see Wang et al. 2003). [However, in both China and Vietnam, efforts to bring equity in land distribution have gone a little too far, leading to what may be called an over-equity situation. Equity in land distribution in terms of quantity, quality and location (*good-with-bad and near-with far)* have led to fragmenting and scattering of household holdings, where a household owns around 5-7 plots, creating inefficiencies in farm management. Such an over-equity in land distribution is now leading to a new set of problems, also in terms of problems in farm management and other related problems].

3. ***Upstream-downstream inequities in water distribution are much higher in South Asian systems compared to those in Southeast Asia and China***. In all the systems studied, irrigation water is allocated to farm households based on size of landholdings; that is, land and water rights tend to be coupled except in China where land rights are decoupled from water rights. Where land distribution is inequitable, as in SSSA, water distribution when measured in terms of total amount allocated per farm household is also inequitable, and vice versa. Inequity in water distribution is directly proportional to inequity in land distribution. In China and Vietnam, where land distribution is highly equitable, water distribution also tends to be equitable or often pro-poor. The study in Chinese systems shows that the poorest farmers, who rely more on farming, have the greatest access to water when measured in terms of per capita or per household use. Also, head-tail inequities in water distribution are greater in SSSA than those on SSSEA. Inequities are more pronounced in relatively larger size systems, where the tail of the tail ends often receives little or no water (see Hussain et al. 2003 for detailed analysis of head-tail inequities in water distribution in India and Pakistan). These findings on tail-end deprivation are also supported by a recent study by Rajagopal et al. (2002) in irrigation systems in Tamil Nadu, Karnatka and Maharashtraare which conclude that "even after taking wells into account the tail-ender problem remains a significant and serious problem than needs immediate attention."

4. ***Land and water productivity is much lower in South Asian systems than in Southeast Asian and Chinese systems.*** In the studied systems, cropping intensity varies from 68 percent to 296 percent. In general, cropping intensity is much lower in SSSA than in SSSEA, and the smaller the average landholding size the greater the intensity of cropping. Land-rich farmers tend to underuse their holdings while the land-poor do not have access to sufficient land. In Javanese irrigation systems, cultivation of three crops per year during the rainy season, dry season -1 and dry season -II is not uncommon. Similarly, productivity per unit of land varies significantly across systems. In general, productivity level is low in SSSA, where it varies from US$230/ha to US$637/ha, with productivity in India higher than that in Pakistan and Bangladesh. On the other hand, productivity is relatively high in SSSEA, where average productivity ranges from US$665/ha to US$1444/ha, with productivity in China higher than in Vietnam and Indonesia. *As for cropping intensity, productivity levels are higher where average*

landholding size is smaller. Comparison of productivity levels of individual crops shows that rice productivity varies from as low as 1,348 kg/ha up to 5,416 kg/ha in SSSA with the lowest productivity level in Pakistan, from 1,348 kg/ha to 3,278 kg/ha. In SSSEA, rice productivity varies from 3,365 kg/ha to as high as 7,396 kg/ha with the highest productivity achieved in Chinese systems from 6,097 kg/ha to 7,396 kg/ha. Similarly, wheat productivity in selected Chinese systems ranges from 4,527kg/ha to 5,295 kg/ha, which is almost double that in most systems in Pakistan, from 1,822 kg/ha to 3,471 kg/ha. Why is productivity level so low in SSSA? Hussain et al. 2003 undertook a detailed analysis of causes of low productivity in Indian and Pakistani systems. They found inequity in canal water distribution, poor quality of groundwater, especially at the tail-end areas where canal water availability is less, and farm-level practices, such as sowing of older varieties and delay in timing of sowing and application of production inputs as the key factors influencing productivity levels. A recent study by the Word Bank (2002) also supports the finding that inequity in land distribution is also one of the major causes of low agricultural productivity in Pakistan.

4. ***Benefits of irrigation are low in systems where land and water distribution is inequitable, cropping patterns are least diversified and overall productivity performance is poor.*** As a result of the above factors, net productivity benefit of irrigation, defined as net value of output from irrigated crop production minus net value of output from rain-fed crop production, varies significantly across systems. As shown in table 3.1, net productivity benefit of irrigation (NPBI) across systems varies from as low as US$23/ha to US$478/ha. NPBI is much higher in SSSEA, which is from US$ 214/ha to US$478/ha compared to that in SSSA, which is from US$23/ha to US$ 206/ha. NPBI is higher for irrigation systems where cop productivity is high and cropping patterns are diversified with high-value crops, i.e., the Krogowanan system in Java. In general, *NPBI is lower in systems where average land size is relatively large, crop productivity is lower and cropping patterns are least diversified with high-value crops.* Overall, in several cases, NPBI is small in South Asian systems, particularly in Pakistani systems. This is due to the overall lower productivity in these systems, which is caused not only due to significant inequity in land and water distribution, but also due to lack of access to key production inputs other than water (see Hussain et al. 2003).

Table 3.1 Land, water, productivity and poverty across selected irrigation systems.

Country	Name of system	Family size	Farm size (ha)	Land distribution	Head-tail equity ratio	Crop intensity	Productivity US$/ha/y)	Irrigation Benefit US$/ha)	%Non-Crop Income	Poverty Headcount %)
Bangladesh	G-K	6.00	0.93	Skewed	1.47	212	448	127	73.5	35
	Pabna	6.00	0.92	Skewed	0.63	180	293	151	75.0	58
India	NSLC	4.63	3.03	Moderately skewed	3.0	89	524	145	64.0	33
	KDS	4.19	1.31	Moderately skewed	2.7	127	637	194	63.1	16
	Halali	7.40	2.9	Fairly skewed	Skewed	112	323	35	50.3	73
	Harsi	8.03	2.1	Fairly skewed	Skewed	68	231	37	47.1	62
Pakistan	9-R	6.49	2.83	Moderately skewed		152	230	42	86.1	42
	10-R	6.71	2.49	Moderately skewed	1.8	162	360	87	78.8	40
	13-R	7.06	3.62	Moderately skewed		183	500	206	61.2	42
	14-R	7.52	3.38	Moderately skewed		164	430	127	69.0	51
	Kakowal	4.48	3.44	Moderately skewed	1.23	153	282	46	80.1	43
	Phalia	7.37	4.84	Moderately skewed		170	413	120	61.2	50
	Lalian	7.92	4.96	Moderately skewed	2	138	404	112	53.1	63
	Khadir	7.84	5.66	Highly skewed	2.5	124	276	54	60.1	77
	Khikhi	9.8	5.16	Highly skewed		137	481	89	70.3	69
	Hakra-4	8.28	6.54	Highly skewed	1.09	152	362	23	75.3	71
China	WID-NP	4.22	1.03	Fairly equal		156	1319		69.6	6
	QID-NP	4.22	0.79	Fairly equal		160	1141		68.8	7
	PID-HP	4.16	0.45	Fairly equal		194	1444		63.7	9
	LID-HP	4.16	0.5	Fairly equal		198	1417		54.1	6

Table Contd.

Table 3.1 (contd.)

Country	Name of system	Family size	Farm size (ha)	Land distribution	Head-tail equity ratio	Crop intensity	Productivity US$/ha/y)	Irrigation Benefit US$/ha)	%Non-Crop Income	Poverty Headcount %)
Indonesia	Nam Thach Han	5.6	0.3	Fairly equal	0.9	186	974	214	71.0	18
	Klambu Kiri	4.97	0.77	Skewed	1.07	253	729	357	40.1	43
	Glapan	4.94	0.73	Skewed	3.01	275	665	292	50.7	40
	Kalibawang	4.47	0.25	Fairly equal	1.45	296	749	376	58.8	37
	Krogowanan	4.31	0.35	Fairly equal		264	851	478	62.1	44

Notes: *Head-tail equity ratio*: Head-tail equity ratio is defined as the ratio of average delivery performance ratio (DPR), which is the ratio of actual discharge to target discharge of the upper 25 percent of the systems to average DPR of tail 25 percent of the system.

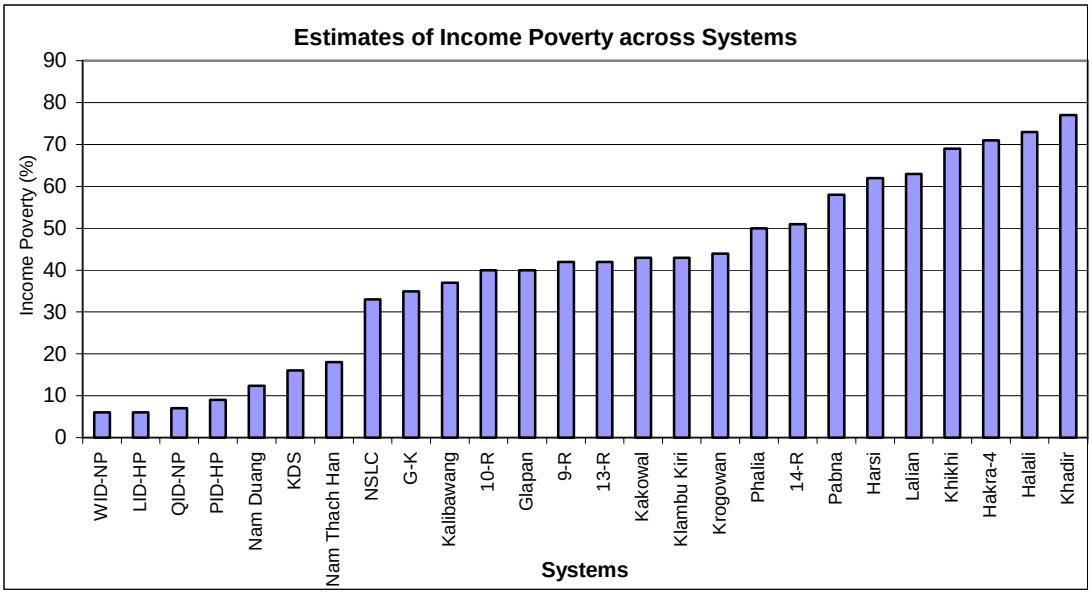
Productivity is gross value of output/ha in US dollars.

Cropping intensity is defined as the ratio of gross cultivated area in a year to design command area.

Irrigation benefit per unit area is defined as the net value of farm production per unit area from irrigated settings minus the net value of farm production per unit area from adjoining rain-fed settings.

6. ***Income poverty in irrigation systems varies from 6 to 77 percent, with higher poverty in South Asian Systems.*** For all the systems studied, around 40 percent of households have incomes below the specified national poverty lines. However, there are significant variations in poverty across systems. The headcount index shows that the incidence of poverty varies from 6 percent to 77 percent (figure 3.1). The poverty gap index shows that the depth of poverty varies from 3 percent to 68 percent. As one would expect, poverty is low in SSSEA compared to that in SSSA, with the lowest poverty in selected systems in China and Vietnam and the highest in the case of Pakistan. In general, poverty is higher in those systems, where land distribution is highly inequitable, productivity and agricultural performance of systems is low and overall benefits of irrigation are low.

Figure 3.1 Estimates of income poverty across systems.



7. ***Income poverty is high among households poor in land, water and education but rich in unskilled labor.*** The study identifies key characteristics of the poor, and indicates that poverty is high among resourceless and resource poor households (land, water and education); among nonfarm households compared to farm households, especially in irrigated agriculture; among households where males/females have no formal education and are unskilled agricultural laborers; among households with a large number of children and single-earning members; among female-headed households particularly in South Asian systems, and in areas characterized by greater inequity in land and water distribution.

8. ***Inequities in land and water distribution, low crop productivity, lack of farm and income-diversification opportunities, and large family sizes are important causes of high poverty in South Asian large-scale canal irrigation systems.*** **An e**conometric analysis suggests that crop productivity, share of non-crop income, land distribution structure and household family size are important determinants of poverty in irrigation systems. Poverty is low in those systems where agricultural performance of systems in

terms of crop productivity is better, farmers diversify their crops and income sources, and land distribution is fairly equitable. In other words, low-level of crop productivity and agricultural performance of systems, inequity in land distribution, lack of income diversification opportunities, and large family sizes are important causes of poverty in irrigation systems studied in Pakistan, Bangladesh and India. Rural non-crop income sources such as livestock and livestock products, agricultural labor, renting out of agricultural equipment and other similar services constitute a significant part of non-crop income in addition to income from nonfarm sources. Increase in crop productivity reduces poverty directly but also indirectly by contributing to expansion in these non-crop activities.

8. ***In South Asian systems, equitable land redistribution and productivity enhancements can have a significant dent on poverty; a 1 percent increase in income from improved crop productivity and associated sources of income would reduce poverty by more than 1 percent.*** The results indicate that, on average, a 1 percent increase in crop productivity level will reduce incidence of income poverty by 0.31 percent. However, the impact will vary across systems depending on the initial level of poverty and productivity. Almost 20 percent of income poverty can be reduced by increasing the productivity level from US$200/ha to US$1,000/ha. Similarly, a 1 percent increase in equity index for land distribution will reduce poverty by 0.48 percent. These values suggest that more equitable land and water distribution will have a significant impact on poverty, which is even greater than the anti-poverty impact of increases in productivity. The impact of the increased non-crop farm and nonfarm income share has the highest antipoverty impact, as a 1 percent increase in non-crop income share will reduce poverty incidence by 0.79 percent. It should be noted that in rural agricultural settings, a significant part of non-crop activities depends on cropping activities, indicating that productivity increases will not only reduce poverty directly but also indirectly through expansion in non-crop activities, such as livestock and agro-based industries.

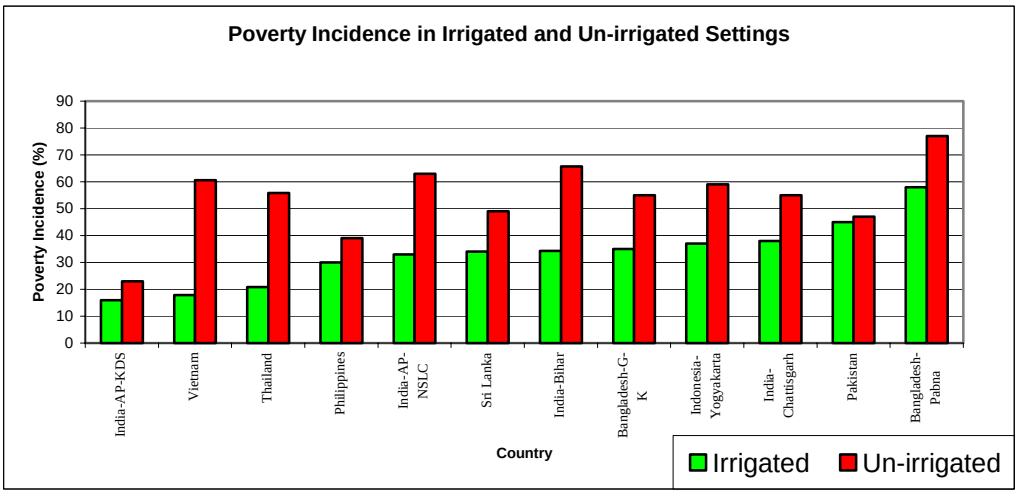
The combined impact of productivity and share of non-crop income in total household income on poverty headcount is 1.1 percent, which indicates that a 1 percent increase in income from crop productivity and associated sources of income would reduce poverty by 1.1 percent. The elasticity estimate derived here is comparable to the estimate of the elasticity of incidence of poverty to agricultural productivity growth of about 1 percent, based on a sample of 40 countries (Thirtle et al. 2001). These results also indicate that direct impact on poverty of income from crop productivity is only one-third of total impacts on poverty from agricultural and agricultural-dependent nonagricultural incomes. Overall, the empirical analysis in this section helps us to clearly establish that there is an inverse relationship between agricultural-productivity growth and rural poverty; and also that an inverse relationship exists between equity in distribution of land and associated water distribution and rural poverty.

B. Impacts of Irrigation on Poverty Alleviation

1. Irrigation has a strong land-augmenting impact, and the value of crop production under irrigated settings is about twice that in rain-fed settings. Irrigation is found to have strong linkages with economic growth and poverty alleviation. Irrigation impacts on poverty alleviation both directly and indirectly. Direct impacts are realized through land augmentation impact of irrigation that translates into improvements in productivity, employment, incomes, consumption and other social aspects at micro or household level. The empirical evidence suggests that irrigation has a strong land augmenting impact, with a cropping intensity and overall crop productivity much higher in irrigated settings than in rain-fed settings. In most situations, the value of crop production under irrigated settings is almost double that in rain-fed settings.

2. Irrigated systems have much lower chronic poverty than rain-fed settings, and irrigation significantly reduces chronic poverty. Further, quantitative evidence shows that household income and consumption are much higher in irrigated settings than in rain-fed settings, and a 50 percent point gap is not uncommon. Ours and other related studies suggest that irrigation is a positive determinant of incomes and expenditures and a negative determinant of poverty. The probability of households with access to irrigation water being poor is significantly less than those without access to water. In most settings, poverty incidence is 20-30 percent higher in rain-fed settings than in irrigated settings (figure 3.2) and irrigation contributes to reducing the worst kind of poverty, i.e., chronic poverty.

Figure 3.2 Poverty in irrigated and nonirrigated areas in selected Asian countries.



Sources: Vietnam 1996: Ut, Hossain and Janaiah 2000: Sample was drawn from eight villages in six districts in four provinces, two each from north and south Vietnam, representing four distinct agro-ecosystems; flood-prone areas in the Mekong river delta, rain-fed lowlands in the Southern region, densely settled lowlands in the Red river delta, and uplands in the northern mountainous region. Philippines 1997: Hossain et al. 2000: sample was drawn from four villages, from two provinces in Luzon and one province in Panay Island Laguna, Central Luzon and Iloilo provinces

representing distinct ago-ecosystems. Thailand 1998: Isvilanonda et al. 2000: sample was drawn from six villages, three each from Suphan Buri in central plain and Khon Kaen in the north-east region. India-Bihar 1996: Thakur et al. 2000; sample was drawn from 16 villages in 8 districts in four agro-climatic regions of the state. India-Chattisgarh 1996: Janaiah et al. 2000: sample was drawn from six villages in two distinct regions in the Raipur district. Bangladesh-G.K Ganges Kobadak 2002: Ahmad et al. 2003. Bangladesh-Pabna 2002: Ahmad et al. 2003. India-AP Nagar Juna Sagar, Andhra Pradesh 2002: Sivimohan et al. 2003. India-AP Krishnia Delta System, Andhra Pradesh 2002: Sivimohan et al. 2003. Pakistan Upper Indus Basin 2001: Hussain et al. 2002. Sri Lanka Udawalawe Left Bank system 2001: Hussain et al. 2002. Indonesia-Yogyakarta 2002: Arif et al. 2003.

3. ***Indirect impacts of irrigation on incomes and poverty are even larger than direct impacts***. Indirect impacts of irrigation on poverty are realized through the expansion of economic activities in both agricultural and agricultural-dependent nonagriculture sectors through backward and forward linkages, resulting in improved economic growth, which contributes to poverty alleviation through multiplier effects. As mentioned above, direct productivity-related antipoverty impacts of irrigation are only one-third of total impacts in command areas. Impacts are much higher when economy-wide multiplier impacts are also accounted for. For example, aggregate irrigation multiplier for India is estimated at 3.15, which means that each US$100 benefit generated by irrigated crop land will generate another US$215 in the local economy as an induced effect (Bhattarai et al. 2002). The total impacts are much higher when other uses of irrigation water (other than crop production such as for cultivation of orchards and trees, and rearing livestock and fisheries) are also accounted for (as will be shown in the last section of this chapter).

4. ***Investments in large- and medium-scale canal irrigation attract the private-sector investments in small-scale irrigated agriculture and other related sectors.*** There are complementarities between public-sector investments in canal irrigation, and private-sector investments in irrigation and other related sectors by farmers, such as investments in groundwater development, and small-scale technologies, financial institutions and businesses. Investments in canal infrastructure development and resulting growth in productivity attract private banks and other businesses to locate their branches where agro-climate and infrastructural conditions are favorable for their financial and business operations.

5. ***In large canal systems, poverty at middle reaches is significantly lower than that at the head and tail reaches; poverty is high where surface water availability is low; groundwater quality is poor; agricultural productivity is low and opportunities in the nonfarm sector are limited.*** The study results show that poverty is significantly lower at middle reaches of the systems, where agricultural productivity is high, compared to that at head and tail reaches. Contrary to common perceptions, the findings suggest that poverty, particularly in South Asian systems, is not necessarily lower in locations within systems that are closer to the source of water, that is head reaches, compared to tail reaches. Inter-reach differences in poverty are more pronounced in larger-size water-scarce systems characterized by inequities in land and water distribution, where inter-reach inequities in canal water distribution and resulting differences in productivity are

high. Variations in groundwater quality also add to such differences. (A detailed analysis for a distributary indicates that reallocation of canal water to tail ends will increase gross margins for head-end farmers by US$12/ha, and for tail end farmers by US$53/ha, with no gain or loss to farmers at the middle reaches. Therefore, canal water reallocation to tailend areas is both productivity enhancing and a pro-poor intervention). The poverty situation tends to worsen in reaches of the systems where surface water availability is low, groundwater quality is poor, agricultural productivity is low and opportunities in the nonfarm sector are limited (i.e. tailends in most systems). Overall, the study suggests that the incidence and severity of poverty are relatively higher at tail reaches than at the middle reaches of the systems, implying that targeting and resource allocation could be (and should be) done to some extent to address the poverty problem in irrigation systems. The findings suggest that these spatial patterns in poverty are correlated with access to water and agricultural performance of systems.

The study undertook a detailed analysis for understanding implications of canal water reallocations to locations within the systems, where presently access to canal water is less and groundwater quality is poor, in two typical canal distributaries (Lalian and Khadir) in the Chaj subbasin in Pakistan. Accounting for groundwater quality and availability of total canal water, allocation of more canal water to the tail ends, which currently receive only little canal water and relying on poor quality groundwater particularly in the Lalian distributary, gross margins at Lalian head and tail reaches would increase by Rs 733/ha and Rs 3,188/ha, respectively, with a decrease in gross margins by Rs 339/ha at the middle reach. In Khadir, the gross margins at the head and tail ends would increase by Rs 28/ha and Rs 395/ha, respectively, while gross margins at middle reaches would decrease marginally by Rs 67/ha. Such a reallocation would result in overall increased productivity in both systems, with significant positive impacts in locations where present productivity level is low and poverty is high. An intervention that strengthens joint management and use of surface water and canal water, and canal water reallocations in such situations would be truly pro-productivity and pro-poor.

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However, the impact of reallocation varies across distributaries and locations within distributaries. In Lalian, gross margins decrease by Rs 339/ha at the middle reach. However, head and tail ends gain by Rs 733/ha and Rs 3,188/ha, respectively. In Khadir, gross margins decrease marginally by Rs 67/ha. However, head and tail ends gain by Rs 28/ha and Rs 395/ha, respectively. Overall, there is almost no change in yields and gross margins at the middle reaches of both systems, but there are some gains at the head ends and substantial gains at the tail ends.

6. ***Access to other factors that enhance the impacts of irrigation by the poor small and marginal farmers are also important to enhance productivity for poverty alleviation in a significant way.*** Small and marginal farmers are generally better-off in terms of access to water in systems where water supplies are adequate and/or system management is better compared to water deficit systems and particularly those where management is poor. Even in situations where small and the poor farmers have access to water they are often constrained to use available water in an optimal way due to lack of access to other necessary production inputs in right quantities and qualities at the right times.

7. ***Poverty impacts of irrigation vary significantly across and within irrigation systems; irrigation can be strongly pro-poor or neutral or even antipoor depending on a number of factors.*** In sum, the study findings suggest that irrigation reduces poverty significantly; however, antipoverty impacts of irrigation vary across and within systems and depend on a number of factors, which include: a) condition of the irrigation infrastructure and its management, b) irrigation water allocation and distribution procedures and practices, c) irrigation and production technologies, cropping patterns and crop diversification, d) support measures, e.g., information, input and output marketing, and e) (in)equity in land distribution and land quality. Analyses from the country studies provide empirical evidence that incidence and severity of poverty are significantly high in those settings where land and irrigation water distribution is inequitable, irrigation infrastructure is poorly managed, and farmers' access to production-enhancing technologies, and support measures is very limited. Where these factors are favorable, incidence of poverty is low. Also, irrigation can create poverty where its mismanagement leads to land degradation problems, such as waterlogging and salinity, and abandoning of lands in the long term. Thus, irrigation can be strongly pro-poor, neutral or even antipoor depending on these conditions.

C. Irrigation System Performance and Poverty Linkages

The study used a number of indicators to measure performance of irrigation systems classified into four categories: productivity, water supply, equity, and sustainability. The key indicators included irrigation intensity, cropping intensity, production in a command area, output per unit of land, water and labor, head-tail equity, water delivery performance, system efficiency, gross and net values of output per unit area, irrigation benefits per hectare and m^3, system profitability, financial self-sufficiency, O&M financing gap and environmental and infrastructure related indicators, and institutional/management indicators.

1. ***Irrigation system performance in South Asia is lower than that in Southeast Asia and China.*** The values of performance indicators vary significantly across the systems studied. In general, performance of the systems is better in Southeast Asian and Chinese systems compared to that in South Asian systems. Performance is lowest in systems studied in Pakistan and Bangladesh. Also, the performance is lowest in systems managed by government agencies while it is relatively better in the transferred systems where management of the systems is more participatory (as will be explained in the next section).

2. ***Irrigation system performance is s significant determinant of poverty***. In econometric estimations, performance of irrigation systems is found to be a significant determinant of poverty, especially in South Asian systems, indicating that there is much more poverty in poorly performing systems compared to relatively better-performing systems..

3. ***Lack of effective institutions, lack of incentives and accountability mechanisms, and inadequate funding are fundamental causes of poor service delivery and poor system performance.*** Poor-service delivery in irrigation, an outcome of poor management of irrigation and irrigation infrastructure, is the fundamental cause of the poor performance

of irrigation system studied. Underlying factors leading to poor service delivery and overall poor performance include: a) lack of appropriate and effective institutional arrangements and/or their effective implementation (including appropriate policies, laws, regulations and management organizations). This include lack of clarity in rights and responsibilities, lack of appropriate incentive structures and effective accountability mechanisms, and b) inadequate funding available and underspending in the sector - an outcome of low-cost recovery resulting from low level of irrigation charges, inappropriate charging structures and poor collection rates. These factors are interrelated and reinforce the impact of one another.

4. ***Irrigation management type and level of service charges influence system performance.*** Results of econometric estimations show that the type of management institutions (centralized/participatory) and the level of irrigation charges significantly influences system performance that, in turn, affects poverty in the systems. In other words, where irrigation management is more participatory and irrigation charges are set at a reasonable level, performance is better and poverty is relatively low. Poor performance of the systems reduces availability and access to water and negates the potential antipoverty impacts of investments in irrigation.

D. Irrigation Service Charging: Implications for the Poor

1. ***In South Asian systems, irrigation charges are not linked to irrigation service delivery.*** In all the systems studied, except in those which have been transferred or where irrigation is managed in a more participatory mode, irrigation charges are jointly determined and assessed by the agency and WUAs, irrigation charges are set administratively by the central or provincial/state governments. Irrigation charges are set at low levels, which reflect neither the cost of supplying water nor the value/benefits derived from water use. The present levels of irrigation charges, particularly in the South Asian systems, are too low to have any influence on farmers' cropping decisions or water use efficiency. In these systems, irrigation charges are not linked to the level of irrigation service and charges are levied irrespective of both the amount of irrigation water delivered/received and the quality and reliability of irrigation supplies. In all the agency- managed systems, irrigation charging, collection and spending are highly centralized. In these systems, revenues generated through irrigation charges do not even cover the required O&M cost of the systems, and the systems have to depend on public-sector subsidies. In those systems where landholdings are inequitably distributed, as in the South Asian systems, a large part of benefits of subsidies to the irrigation sector goes to large landholders. In the transferred systems or where there are decentralized institutional arrangements for irrigation management and service delivery, charge collection and spending mechanisms are decentralized and overall performance is relatively better than those solely managed by the public-sector agencies.

2. ***In South Asian systems, revenues from irrigation charges are remitted to the government and there is no direct link between funds collected and funds spent on O&M***. In the studied systems in Bangladesh, India and Pakistan, irrigation charging

system is fairly similar. The level and structure of irrigation charges are determined by the state/provincial governments. Irrigation charges at the farm level are levied based on area cultivated/cropped, crop type, crop condition and season (rabi/kharif). In each season, irrigation charge assessment at the field level is undertaken by irrigation/revenue department officials. Even in transferred systems in Andhra Pradesh, Madhya Pradesh, and Hakra-4 in Pakistani Punjab, irrigation charges are determined by public authorities while assessment is either jointly undertaken by government officials and WUAs or in some cases by WUAs as in Hakra-4 R. Within a state or province, irrigation charges are generally uniform across canal commands, irrespective of the amount of water delivered to a canal command. Variations in canal water allocations are not clearly reflected in the charging structure. At present, revenues from irrigation charges are remitted to the government and there is no direct link between funds collected and funds spent on O&M. Overall, irrigation charges are low, either because of low level of charge or poor collection rate, and governments provide funds that are often inadequate for necessary O&M.

3. ***In the transferred systems in Indonesia, multiple criteria are used in assessing irrigation charges***. In Indonesian systems, especially in those which have been transferred (having more decentralized institutional arrangements for irrigation management), multiple criteria are used in determining irrigation charges at the tertiary level including cropped/irrigated area, crop type, crop productivity, location, level of service and users' capacity to pay. Variations in canal water allocations are implicitly accounted for in charging systems. Farmers using more water by irrigating a larger area or by growing water-intensive crops or achieving higher productivity pay more, introducing an element of equity in irrigation charging systems. An additional criterion of farmers' capacity to pay introduces poverty concerns into the charging system, with the poor farmers paying relatively less than the nonpoor farmers. Under a multiple-criteria-based charging system (as in the transferred systems) the structure of charging is such that charges are linked to water supplied/used, and it accounts for poverty concerns. The key issue for cost recovery in these systems is the level of irrigation charges.

4. ***In Chinese and Vietnamese systems, irrigation charges tend to be related to the level of service and O&M costs.*** In the Chinese and Vietnamese systems studied, irrigation charges are directly or indirectly linked to the irrigation service, and water supplied/used. In the studied systems in Vietnam, irrigation is charged, based on the level of output produced. Charges vary across systems, and are differentiated by the level of service, that is, households receiving partial irrigation service pay less, IDMCs and Cooperatives sign water-delivery and water-fee contracts, and charging and spending are partially decentralized. In the Chinese systems, the level and structure of irrigation charges are determined by the local water resources bureaus under the guidelines from the provincial governments. At the field level, irrigation charge is based on area irrigated and, in some cases, time period to irrigate the fields. Irrigation charges appear to be related to the cost of O&M and overall cost of supplying water. Under these systems, irrigation charges, regardless of whether based on size of landholdings or on cropping intensities, tend to be relatively equitable. In these systems, what is important for cost recovery is the level of irrigation charges.

5. ***Level of irrigation charge is much lower in South Asian systems than that in Southeast Asian and Chinese systems.*** In South Asian systems, level of irrigation charges varies from US$4.6/ha to US$22/ha. While the irrigation charge level is highest in Bangladeshi systems, the collection rate is very low (5-15%). Irrigation charges in the Indian systems have recently been increased to US$10/ha, with the collection rate varying significantly across systems. In Pakistan, irrigation charges vary from US$4.6/ha to US$10.6/ha, and overall collection rate is higher (80-99%) than that in Bangladeshi and Indian systems. In Indonesia, irrigation charges vary from US$1/ha to US$20/ha, and the collection rate is reasonable, especially in the transferred systems. On the other hand, irrigation charges in China and Vietnam are much higher than those in Indonesia and South Asian systems. In China, irrigation charges vary from US$26 to US$76/ha (1.8 to 5.2% of gross value of product/ha), with a collection rate of 80 percent. In Vietnam, where irrigation is charged based on crop output, the irrigation charge level is fairly high (US$58 to US$61/ha) reflecting high O&M cost of pumps, constituting 4.6 and 6.3 percent of gross value of product/ha, and overall collection rate is also high (85 to 99%).

6. **The consequences of the low level of irrigation charges in the South Asian systems are multifold, as when and where irrigation charges are low:**

- Revenues and funds available for irrigation management are low, and the sector has to depend on financial allocations from the public sector, which are often inadequate to carry out necessary operations, maintenance and management. Consequently, maintenance is neglected, infrastructure condition deteriorates, performance of the systems is adversely affected, availability and access to water are reduced, especially at the tail ends, and the poor are affected the most. However, the magnitude of adverse impacts on the poor varies depending on the distribution structure of land and water resources. In those settings, where there is relatively greater inequity in land and water distribution as in South Asian systems described above, low irrigation charges and lower-than-required O&M of the systems and the resulting poor performance of the systems affect the poor and the weaker more than the nonpoor and the powerful***. Low level of charges leads to poor maintenance and overall performance of systems, and affects the poor's access to water.***

- Managers and service providers, receiving a large part of funds from central agencies/treasury, have little or no incentives to spend funds efficiently, and deliver high-quality services; users paying low charges feel they have little entitlement, and there are few incentives for them to demand for improvements in service delivery; and accountability linkages in terms of spending and service delivery between managers, service providers and users remain weak. As a result, irrigation service delivery continues to be poor and system performance, in terms of water use efficiency and productivity, remains low. Poor irrigation performance reduces access to water, particularly of the poor, with adverse impacts on their livelihoods. In other words, poor service delivery and low irrigation charges create a vicious circle of poor irrigation performance, and

reduce antipoverty impacts of irrigation (for details see World Bank 1999; Hussain and Biltonen 2002). ***Low level of charge creates disincentives for farmers and service providers, weakens accountability linkages and leads to a vicious circle of poor performance in irrigation.***

- When irrigation charges are low, there are no incentives for users to use water efficiently and avoid wasteful use of water, resulting in reduced overall availability and access to water. When access to irrigation water is at very little cost to the users, the nonpoor, the powerful and those having locational advantage tend to grab more than their due share, especially in settings where water rights are not clearly defined and enforced; not only do they use it in an unsustainable manner but they deprive others, particularly the poor and the weaker. On the other hand, where irrigation charges are high, farmers use water carefully and benefit from each drop of water. For example, in most Chinese systems, irrigation charges are fairly high, water is used relatively effectively and the productivity per drop of water is also very high; ***low level of irrigation charges leads to inefficient production.***

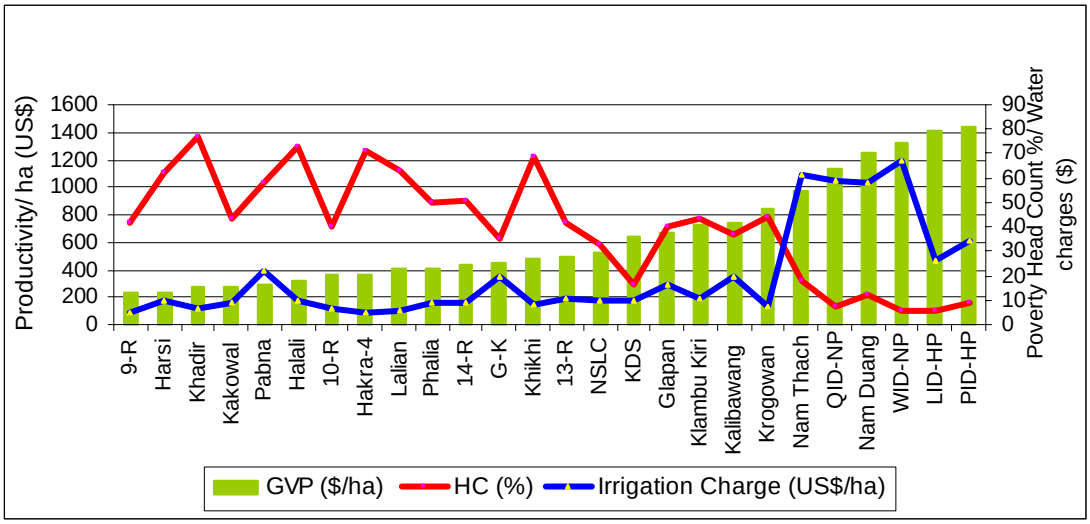
- In settings where there is greater inequity in distribution of land and water as in most South Asian systems, the low irrigation charge policy applied uniformly to all socioeconomic groups worsens income and resource disparity between the poor and the nonpoor, as a large part of the benefits of subsidies to the sector goes to the large landholders. ***Low charges worsen income and resource disparity.***

- The low irrigation charge policy and financial dependence on public-sector agencies may also affect collection and spending efficiencies. It should be noted that, for the irrigation service charge policy, it is not only the level of irrigation charge that is important, but also the structure of charge, the collection and spending mechanisms and associated institutional arrangements in terms of implications for the poor. ***Charge collection and spending procedures also matter.***

7. ***Low irrigation charges lead to poor system performance, which is one of the important causes of poverty in South Asian systems.*** As shown in figure 3.3, in those systems where irrigation charges are low, overall performance of the systems in terms of water use efficiency and productivity/ha is also low. For example, water use efficiency, defined as the ratio of crop water requirements and total inflow into the canal system in Pakistani systems, varies from as low as 28 percent to 71 percent, and crop productivity in these systems is low. In general, in the low performing systems where agricultural productivity is low, the incidence of poverty is high. On the other hand, where systems are well managed and overall performance is high, the incidence of poverty is also very low. Of course, poverty is the outcome of many complex factors; agricultural productivity is one of the important determinants of poverty, and this is particularly so in those settings where households and communities depend for their livelihoods on agriculture. Low level of irrigation charges, leading to overall poor system performance, reduces the antipoverty

impacts of irrigation. The quantitative analysis indicated that irrigation charge is a significant determinant of irrigation system performance that, in turn, influences poverty in irrigation systems.

Figure 3.3 Productivity/ha, poverty (%) and irrigation charge (US$/ha).



8. ***Irrigation charge collection efficiency is generally high in systems with better performance, having decentralized arrangements for spending of collected revenues.*** Irrigation charge collection rate varies from 5 percent to 99 percent in the 26 systems studied, with the lowest collection rate in Bangladeshi systems and the highest in Vietnam. Overall, collection rate is higher in the studied systems in Southeast Asia and China, and lower in systems in South Asia. In general, the collection rate and overall collection efficiency are high in those systems where service delivery and overall performance are satisfactory, and where there are decentralized institutional arrangements for spending of the collected revenues as in transferred systems in Pakistan (Hakra-4R), Indonesia (Kalibawang and Krogowanan systems), Vietnam (village-level Cooperatives and Irrigation and Drainage Management Companies), and in Chinese systems (village-level Cooperatives, WUAs and contractors). Collection efficiency is low in those systems where collected revenues are remitted to the treasury and the system maintenance and management depend on public-sector budgetary allocations. Under the decentralized institutional arrangements for collection and spending, water users have incentives to pay charges as they see that the amount paid is being spent for improving system performance, and also there is informal social pressure on them for payment of charges.

9. ***The poor are willing to pay. In some cases, poor, small and marginal farmers pay more for irrigation than large and nonpoor farmers.*** Sometimes concerns such as "affordability and willingness to pay" of farmers are offered as justifications to keep irrigation charges at low levels. A detailed analysis for Pakistani systems indicates that small and poor farmers pay more in total per hectare cost of irrigation than large and nonpoor farmers. They pay more for canal water charges, as the charge is based on

cropping intensity, which tends to be higher on smaller-size farms; because of the less availability of canal water they make relatively greater use of groundwater which they mostly buy, which is around nine times expensive than canal water. On average, groundwater cost constitutes over 20 percent of gross value of production per hectare (GVP/ha) compared to canal water that constitutes only 2.5 percent of GVP/ha. In this situation, any attempt to raise irrigation charges without correcting the structure of charging would harm the poor farmers more than the nonpoor farmers. For Pakistan, the study analyzes the implications for the poor of three irrigation charge policy options:

Option 1: Present policy: No change in the structure and level of irrigation charges, which are based on cropped areas and cropping intensities.

Option2: Flat rate policy. The flat rate per unit of irrigated land based on land size, independent of crop type and cropping intensities; the present average irrigation charge is applied uniformly across all farm size categories.

Option 3: Differential rate policy: The differential rate per unit of irrigated land based on land size, applied differentially across various farm size categories (progressive rate structure similar to increasing block rate charging). Lower irrigation charge for the first two hectares, applied uniformly to all land-size categories, and charge increases progressively with increase in size of landholdings above 2 hectares, by Rs 50/ha for each successive category of land size.

The analysis suggests that the present charging policy is pro-large farmers, the flat rate policy would be more equitable and the differential rate policy would be pro-poor. For the country as a whole, option 2 would result in annual gains for small farmers through reduced costs by Rs 130.06 million, and cost to larger farmers would increase by Rs 605.97 million, and annual total revenues will increase by 5.6 percent. Under option 3, smaller farmers, as a result of reduced costs, would gain by Rs 519.65 million, and larger farmers would contribute more towards costs by Rs 842.45 million, and overall revenue would increase significantly by 22.7 percent. With policy option 3, over Rs 1,362 million would be redistributed with a significant part in favor of poor small landholders in Pakistan. Option 3 is better than options 1 and 2 from revenue and equity perspectives. Option 2 is relatively equitable, option 3 is pro-poor, as per hectare irrigation charge to the poor would be less than that to the nonpoor, and would be significantly less than that for options 1 and 2. Option 3 is a win-win scenario in terms of cost recovery and benefits to the poor.

10. Low irrigation charge policies are hurting the poor more than the nonpoor, mostly indirectly but also directly in some cases. The study findings imply that the low level of charges applied uniformly to all socioeconomic groups of farmers is disadvantageous to the poor, as it adversely affects the system performance. In settings where land and water distribution is highly inequitable, differential-charging systems may be introduced to directly benefit the poorest of the poor. Based on the analysis and the evidence presented, the study suggests that there is a need to increase irrigation charges to the level that adequately covers the required costs for improving system performance. Revenue collection and spending mechanisms also need to be improved. This would require appropriate and effective institutional arrangements, and incentive structures in overall management of irrigation systems. Detailed characteristics of irrigation charging methods for each of the six countries and their strengths and limitations are outlined in table 3.2 and 3.3.

Table 3.2 Water charges in selected irrigation systems.

Country	System name	Location	Management	Water charge set by	Basis of water charges	Annual water charge/ha– (US$)	Water charge as % of GVP	Collection rate (%)	Land distribution
Bangladesh	G-K	Southwestern Bangladesh	Agency	CG	Crop area based	20	4.46	5-15	skewed
	Pabna	West-central Bangladesh	Agency	CG	Crop area based	22	7.51	9	skewed
India	NSLC	Andhra Pradesh/Krishnia river-upstream	Transferred	SG	Crop area based	10	1.91	40-50	moderately skewed
	KDS	Andhra Pradesh/Krishnia river-downstream	Transferred	SG	Crop area based	10	1.57	82	moderately skewed
	Halali	Madhya Pradesh	Transferred	SG	Crop area based	10	3.09	33	fairly skewed
	Harsi	Madhya Pradesh	Transferred	SG	Crop area based	10	4.33	21	fairly skewed
Pakistan	9-R	Upper Jehlum canal	Agency	PG	Crop area based	4.6	2.94	99	moderately skewed
	10-R	Upper Jehlum canal	Agency	PG	Crop area based	6.9	2.09	99	moderately skewed
	13-R	Upper Jehlum canal	Agency	PG	Crop area based	10.6	2.06	80	moderately skewed
	14-R	Upper Jehlum canal	Agency	PG	Crop area based	8.8	2.41	80	moderately skewed
	Kakowal	Upper Jehlum canal	Agency	PG	Crop area based	9.3	3.51	80	moderately skewed
	Phalia	Upper Jehlum canal	Agency	PG	Crop area based	8.8	2.31	80	moderately skewed
	Lalian	Lower Jehlum canal	Agency	PG	Crop area based	5.6	2.84	87	moderately skewed
	Khadir	Lower Jehlum canal	Agency	PG	Crop area based	6.9	3.90	87	highly skewed
	Khikhi	Lower Chenab canal	Agency	PG	Crop area based	7.9	1.66	94	highly skewed
	Hakra-4	Hakra System	Transferred	PG	Crop area based	4.6	1.72	91	highly skewed

Table contd.

Table 3.2 (contd.)

Country	System name	Location	Management	Water charge set by	Basis of water charges	Annual water charge/ha– (US$)	Water charge as % of GVP	Collection rate (%)	Land distribution
	QID-NP	Ningxia Province-Northwestern China upper YRB)	Village Cooperatives	PG	Cultivated area based	59	5.17	80	fairly equal
	PID-HP	Henan Province-Eastern China Lower YRB)	Village Cooperatives	PG	Cultivated area based	34	2.35	80	fairly equal
	LID-HP	Henan Province-Eastern China Lower YRB)	Village Cooperatives	PG	Cultivated area based	26	1.83	80	fairly equal
Vietnam	Nam Duang	Red river delta	Village Cooperatives, IDMCs	PPC	Crop area based	58*	4.6	85-95	fairly equal
	Nam Thach Han	North Central Region	Village Cooperatives, IDMCs	PPC	Crop area based	61*	6.3	99	fairly equal
Indonesia	Klambu Kiri	Central Java	Agency	WUAs	Multiple criteria	6-11	0.8 to 1	-	skewed
	Glapan	Central Java	Agency	WUAs	Multiple criteria	4-16	0.8 to 4.3	-	skewed
	Kalibawang	Yogyakarta	Transferred	WUAs	Multiple criteria	13-20	0.6 to 2.2	95	fairly equal
	Krogowanan	Central Java	Transferred	WUAs	Multiple criteria	1-7	0.2 to 0.6	-	fairly equal

Notes: IDMCs: Irrigation and Drainage Management Companies; G-K = Ganges Kobadak; NSLC = Nagarjuna Sagar Left Bank canal; KDS = Krishna Delta Systems; WID-NP =Weining Irrigation District in Ningxia province; QID-NP = Qingtongxia irrigation district in Ningxia Province; PID-HP = People's Victory Irrigation District in Henan province; LID-HP = Liuyuankou Irrigation District in Henan Province; CG = Central Government, SG = State Government, PG =Provincial Government, PPC =Province People's Committee.

* These values are based on cost of full irrigation fee for partial irrigation is lower. Average rice yield/ha for both spring and summer crops for Nam Duang (ND) and Nam Thach Han (NTH) systems are 8,766 kg and 9,241 kg, and average fee for full irrigation for ND is 209 kg/ha for spring and 194 kg/ha for summer total 404 kg/year), and for NTH average fee for full irrigation is 290 kg/ha/season (total = 580 kg/ha/year). Estimated average local price for paddy is VD2,270/kg for ND system and VD1,672/kg for NTH systems. Using these values, average annual fee/ha is VD917,135 for ND and VD969,700 for NTH.

Table 3.3 Comparison of water charging methods in selected systems.

Studied systems	Characteristics of water charging system
South Asia Bangladesh, India and Pakistan	• Level and structure of irrigation charges are determined by the state/provincial government. • There is no volumetric-based charging. • Irrigation charges are based on area cultivated/ cropped, and differentiated by crop type, crop condition and crop season dry/wet. Charges are generally higher for high water-consuming crops such as rice, and low for less water-consuming crops such as wheat. • Irrigation charges are uniform across canal commands within a province or state, irrespective of the target amount of water delivered to a canal command. • A crop irrigated partially from surface water and partially from groundwater is fully liable for canal irrigation charges. • Level of irrigation charges is generally too low to affect farmers' cropping decision. • Level of irrigation charges is low and government provides subsidies. • Irrigation charge collection and assessment are undertaken by government officials. • Irrigation charges constitute 2 to 7 percent of gross value of production/ha. • Collection rate varies across systems, with the lowest rate of 5 to 15 percent in Bangladeshi systems, 20 to 80 percent in Indian systems, and 80 to 99 percent in Pakistani systems. • Collected amount is deposited in treasury, and O&M funds are allocated from annual budgetary allocations for the sector. • Irrigation charges are not linked to O&M cost or cost of supplying water. • Irrigation charges are not linked to level of service; charges are levied irrespective of amount of water received, and regardless of full irrigation or partial irrigation, quality and reliability of water supplies • Within systems, uniform charges are applied to all locations in a system, and for all socioeconomic groups. • In the transferred systems, WUAs still depend on government budgetary allocations. • The irrigation charge system is highly centralized, especially in systems managed by agencies. • In the transferred systems of India and Pakistan, 40 to 50 percent of funds collected through irrigation charges are to be given to WUAs for maintenance. However, in most systems, this mechanism is yet to be implemented.

Indonesia	• Level and structure of irrigation charges are jointly determined by the agency and WUAs. • In the transferred systems, WUAs and WUAF play greater roles in determining the level and structure of irrigation charges. • There is no volumetric-based charging. • Irrigation charges are based on area cropped/irrigated, cropping intensity, crop type, availability of water supply and its reliability, O&M requirements, farmers' satisfaction and farmers' capacity to pay. • Interestingly, irrigation charges are also differentiated by location head, middle and tail, with lower charges in low productivity areas. • Irrigation charges consist of several components including irrigation service fee around Rp 15,000/ha/year), development fee, material and labor. • If amount collected is insufficient, the government provides the required funds. • Irrigation charges are collected by WUA staff from farmers individually or during WUA meetings. • Administrative cost of irrigation charges; collection varies from 5 to 15 percent. • Amount collected is deposited to WUAs' treasurer and WUAs' bank account. • In the transferred systems, WUAF plays an important role in the collection of irrigation charges and use of collected funds at the secondary canal level. • Irrigation charges are partially linked to O&M and level of service. • In the transferred systems, overall collection rate is higher. For example, in the Kalibawang system, collection rate has increased from 59 percent in 1998/99 (before transfer) to 79 percent in 1999/00 (after transfer) and further increased to 90 percent in 2000-01. • In the transferred systems, where WUAs are functioning well, such as in schemes in the Kalibawang system, collection rate is 95 to 100 percent. • Overall, irrigation charging system is fairly decentralized.
Vietnam	• Level and structure of irrigation charges are determined by the provincial government. • There is no volumetric-based charging. • Irrigation charges are based on crop type, cropping season spring/summer), and crop output. • Irrigation charges are also differentiated by level of service, i.e., partial or full irrigation, with households receiving partial irrigation, paying fewer charges. • Irrigation charges vary across systems. IDMC and Cooperatives sign water delivery–water fee contract. In the Nam Duang system, for example, the irrigation charge is set as follows:

	- 209 kg of rice/ha for spring rice for full irrigation, - 181 kg/ha for spring rice for partial irrigation, - 195 kg/ha of rice for summer rice for full irrigation, - 146 kg/ha for partial irrigation, and - 80-90 kg/ha of rice for upland crop. • Cooperatives collect irrigation charges, and the administrative cost of fee collection is 5-6 percent. • Collection rate is fairly high: 85 to 99 percent. • Amount collected through irrigation charges is the main source of income for IDMCs, where the amount collected is generally not sufficient for O&M, and the provincial government provides funds. • In a way, irrigation charges are partially linked to O&M costs and level of service. • The irrigation charge system is partially decentralized.
China	• Level and structure of irrigation charges are determined by local water resources bureaus (county/township) under the guidelines provided by the provincial and central governments. Consequently, there is significant spatial variation in level and structure of irrigation charges. • In some systems, volumetric-based irrigation charges are implemented at the main canal level where water can be measured. • At the farm level, irrigation charges are mostly based on area irrigated or, in some cases, based on the time period, to irrigate a field or, in a few cases, based on a number of members in a household. • In the Ningxia Province, a three-part irrigation charging system is in practice: a) the first part is volumetric water pricing measured at outlets of the main or branch canals and is set at a level that is supposed to cover the variable costs associated with the supply of water including staff salaries and O&M of main and branch canals; and since 2000, this is set equal to0.012 yuan/m^3; b) the second part consists of local water maintenance and management fee set at 6 yuan/mu, which cannot exceed 90 yuan/ha (1 ha=15 mu) ; and c) the third part is labor-discounted fee used for irrigation districts maintenance works set at 4 yuan. • Amount collected on volumetric basis; the first part is deposited to the irrigation district's government and is used for O&M of main canals and staff salaries. Of the amount collected through local maintenance and management fee, the second part, 40 percent goes to County Water Resources Bureau, and 60 percent to Township Water Resources Bureau, and is used for facility maintenance and staff salaries at these levels. • In Ningxia, fee collection procedures vary across villages: farmers to village collectives or WUAs where they exist or contractors to township governments and then to irrigation district government.

	In some cases, WUAs and contractors collect fees from farmers and directly deposit to irrigation districts. • On the other hand, irrigation charges in Henan Province are based on cropped area: Paddy areas – 22 yuan/mu; dry and gravity irrigation areas – 12 yuan/mu; and lift irrigation areas – 7 yuan/mu. • Irrigation charges are differentiated by location. Water charges are generally higher in upper reaches of the systems where the share of rice area is higher than in the lower reaches. Since water charge for rice is higher than that for dry crops, overall water charges are higher in the upstream areas. • In the studied systems in Ningxia and Henan, water charge collection rate is over 80 percent. Collection rate is higher where private contractors and WUAs are operating at the local level, as they tend to cut deliveries in case of nonpayment of charges. • Irrigation charges appear to be related to cost of O&M, and the overall cost of supplying water and relative water scarcity. Irrigation charges in Ningxia located upstream of YRB, with more water supplies, and relatively less cost of supplying water are lower than in Henan Province. • In the systems where water management reforms are being implemented through formation of WUAs or by bringing private contractors/managers, performance of systems is generally better. • Overall irrigation charging methods are fairly decentralized in the studied systems.

Strengths and Limitations of Alternate Charging Methods

Each of the irrigation charging methods described earlier has its own set of strengths and limitations. Some of the identified strengths and limitations of charging systems in South Asian and Southeast Asian systems are presented in table 3.4.

Table 3.4 Strengths and limitations of alternative water charging systems.

Charging systems	Strengths	Limitations
Cropped-/cultivated-area-based charges, differentiated by crop type and cropping season South Asia	• Irrigation charges are differentiated by type of crop grown, higher water charges for high water-consuming crops such as rice. • Irrigation charges can be differentiated by season, with higher charges in the dry season. • Transaction cost of seasonal irrigation-charge assessment and collection is lower in transferred systems where these responsibilities are entrusted to WUAs.	• Transaction cost of seasonal assessment of areas cultivated/cropped and of irrigation charge collection is generally high. • The charging system is complex as it requires seasonal assessments and a large amount of recordkeeping. • It is easily subject to abuse through underestimation of areas cropped, and mis-recoding of the crop type. • It penalizes farmers who supplement surface supplies with groundwater, as in Pakistan. • Variations in canal-water allocations are generally not reflected in the charging structure. • Irrigation charges are administratively set, generally at low level, which do not reflect value of water or the cost of supplying water. • Irrigation charges are uniform across head, middle and tail; charges are levied irrespective of level of service provided. • The charging system does not account for locational differences in productivity that may be due to locational inequity in water distribution. • The charging system does not account for farm or landholding size or socioeconomic groups, which may have strong equity implications. • Irrigation charges are not linked to the amount of water supplied or quality of water, and do not provide any incentive for efficiency in water use. • Water charges are not linked to farm income, productivity level, or O&M costs.
2. Cropped area-cum-output-based charges, differentiated by crop type and cropping season (Vietnam)	• All the above advantages of cropped-/cultivated-area-based charges. • Charging system is partially flexible • The charging system partially accounts for farmers' capacity to pay. • Implicitly, irrigation	• The irrigation charging system does not account for farm or landholding size or socioeconomic groups, which may have strong equity implications. • Irrigation charges are not linked to the amount of water supplied or quality of water, and do not provide any incentives for efficiency in water use.

	charges are not uniform across systems. It accounts for locational differences in productivity that may be due to differences in locational availability and access to water. • Irrigation charges reflect benefits derived from water use. • Seasonal assessment of crop areas and productivity can be made based on the last 5-year averages.	
3. Multiple-criteria-based water charges – crop area, productivity, location, level of service, farmers' capacity to pay (Indonesia)	• All the above advantages of cropped-/cultivated area based charges, and cropped area-cum-output- based charges. • Charging system is more flexible • It accounts for farmers' capacity to pay • Administrative cost of irrigation charge assessment and collection is low in the transferred systems	• Administrative costs of water- charge assessment and collection are high in non-transferred agency- managed systems
4. Two/multi-part-charging system (China) Part 1.Volumetric-based water charges, based per cubic meter at the main canal level Part 2 – Crop-/ cultivated-area-based charges	• All the advantages of 1 and 2 above. • It helps generate funds for management and maintenance of systems at primary level as well as at secondary level. • It can facilitate development of markets for canal water, and canal water wholesaling at the main canal level. • It encourages local-level authorities/organizations to save water, given the incentives to managers or contractors.	• Volumetric-based irrigation charges can be implemented only where water measurements can be easily done.

E. Institutional Reforms in the Irrigation Sector: Implications for the Poor

Institutional reforms in irrigation/water-resources sector are presently underway in all the study countries, though the progress is slow in South Asian countries than elsewhere. The reforms focus on three major areas: formulation of irrigation water policies, development of legal and regulatory frameworks and changes in irrigation finance/charging as described earlier and the establishment of new institutions for PIM/irrigation-management transfer. New irrigation/water policies and laws have recently been developed in the study countries: India - National Water Policy 2002; Pakistan - National Water Policy 2002; Bangladesh - National Water Policy 1999; Indonesia - Irrigation Management Policy 1999; Vietnam - Law on Water Resources 1998; and China National Water Law 1988; and enforcement and implementation of the newly formulated policies and laws are yet to be realized. The new policies emphasize on integrated management of water resources from a basin perspective, equity in water- sharing and allocation, financial, physical and environmental sustainability of water resources, and institutional reforms and participatory approaches to water management. While the new policies do recognize the role of water resources in poverty alleviation, there are no explicit policy principles addressing poverty concerns or any specific pro-poor provisions in the policy documents.

At the irrigation-system level, the formation of water user associations/organizations for PIM has been one of the major initiatives in the irrigation sector. The initiative aimed to a) reduce costs to government, b) improve productivity, profitability and overall performance of irrigation management, and c) relate irrigation management more adequately to the actual needs of the water users. The study assessed the implementation progress and analyzed the effectiveness of reforms, with a focus on assessing their implications for the poor. Details of findings, reported in individual country study reports, are summarized in table 3.5. The following are some of the key lessons learnt from the country studies.

1. ***Reform implementation progress is slow in Bangladesh, Pakistan and Indonesia.*** The institutional reforms in most large- and medium-scale canal irrigation systems—IMT and PIM—were initiated on a large scale since mid 1990s. Reforms began few years earlier (in 1994-95) in Bangladesh, China and Vietnam than in India, Pakistan and Indonesia (in 1997-98). In China, India and Vietnam, reforms have been implemented at a wider scale in a number of provinces and states, while in Bangladesh, Pakistan and Indonesia implementation has been carried out only in few major systems. In most cases, reforms have been implemented on pilot project basis or in experimental mode. Implementation progress varies across countries and systems within countries, with implementation progress being much slow in Bangladesh, Pakistan and Indonesian systems studied.

2. ***New institutional arrangement for management of medium- and large-scale canal systems consists of a three-tier organizational structure in all the systems in the six countries***. In all the systems studied in the six countries, the new organizational structure for irrigation management consists of three tiers: tertiary- level organization for managing tertiary levels of canal (water user association/water user group/Cooperative), secondary-level organizations for managing secondary level of canals (farmer organizations/distributary-level committee/ irrigation management enterprise), and primary-level organization for managing primary canal (Area Water Board/ Project

Committees/ Water Management Federation/ Water User Association Federation/ Irrigation Drainage and Management Company), with different names across countries for a similar or the same level of organizations. The new organizational structures correspond to the spatial structure of large- and medium-size canal systems. In all study countries, the upper level of the irrigation network including dams, reservoirs, rivers and main canals are managed by public-sector agencies.

3. ***The new institutional framework has been implemented only partially.*** In the systems being reformed, tertiary-level organizations have been established and efforts have been made to make them functional; secondary-level organizations have also been established in most cases, and most of them are gradually becoming functional; and primary-level organizations have not yet been established or they are not yet functional in most cases except for IDMCs in Vietnam. Therefore, the new institutional arrangement and the proposed reform model have been implemented only partially.

4. ***O&M grants have provided significant incentives to new organizations to be functional***. Three key elements of reform implementation strategy are common across countries: establish a management organization, rehabilitate/improve irrigation infrastructure or provide O&M grants to the organizations after transfer, and increase irrigation service charges, all three simultaneously or in sequencing. O&M grants from government and donors have been important sources of funds for most newly established organizations, and is perhaps one of the major incentives for management organizations to be functional and carryout O&M activities (incentive-based reforms).

5. ***So far the focus has been on the hardware side with only little attention to the software side of irrigation management.*** Under the reforms, management organizations were supposed to carryout both infrastructure management and water management (allocation) functions; however, in most cases, particularly, the systems studied in India, Pakistan and Bangladesh, the organizations that have been functional have only been focusing on infrastructure maintenance works with only little attention to water management functions, such as water allocation and distribution at various levels, water sharing and water use efficiency.

6. ***Reforms have led to improved maintenance, increased crop productivity, reduced inequities in water distribution and increased funding, but the full range of impacts remains to be seen***. While it is too early to assess effectiveness and the full range of impacts of reforms, results from the pilot projects and experiments present a mixed picture. Results from the systems studied in India and Pakistan show that reforms have led to improved O&M of systems; increase in irrigated crop areas, for example, by a 6 percent increase in crop areas in the Hakra-4R system; increased crop productivity, for example, around 20 percent increase in crop yields of paddy and maize in the Andhra Pradesh system; increase in equity in water distribution, for example, improvements in a head-tail equity ratio of 1 in the Hakra-4R systems in Pakistan; increase in irrigation charges, for example, irrigation charges in Andhra Pradesh increased three-and- half times from Rs 100-150/ha to Rs 500/ha after reforms; improvements in collection rates for example, collection rate increased to 88 percent and 95 percent in the transferred

systems in Pakistan and Indonesia, respectively; cost effectiveness in O&M works; and improvements in reliability and access to water at tail ends. Other benefits included reduction in water theft, reduction in litigation cases related to irrigation water and rent seeking by irrigation officials, improved assessment of water charges, and increased information sharing among farmers.

7. ***The poor have also benefited from reforms***. Reforms have benefited the poor in three ways: a) increase in O&M works undertaken after the implementation of reforms have generally benefited the landless, marginal and small farmers by creating more employment opportunities for them; b) improved reliability and equity in water sharing, increased access to water at tail ends where there is relatively more poverty and resulting increased productivity and returns to farming; and c) other monetary and nonmonetary benefits from improved management and system performance, such as reduction in water-related disputes, increased information sharing, community empowerment, increased employment opportunities for wage earning resulting from overall increased productivity—all three are important pro-poor aspects of reforms. Overall, the reforms can be said to have contributed to creating an environment for improved irrigation management, and to increasing benefits of irrigation-related investments to the poor.

8. ***But, if not implemented effectively, reforms may be disadvantageous to the poor.*** On the other hand, there are some critical issues that could potentially disadvantage the poor. In South Asian systems studied, several management committees of water user organizations are operating more like contractors forming an unholy nexus with irrigation officials and competent authorities. High- caste domination is shown among management committees of organizations in the Indian systems studied both in AP and MP, and sometimes this is a strategic choice by farmers. In MP, for example, farmers have strategically elected large and powerful farmers as presidents from tail-end reaches to ensure that water reaches the tail ends. The choice of generally large and influential people as presidents was driven by the desire of farmers to have some one strong enough to negotiate with irrigation agency and outside people. Further, such people are believed to have the capacity to spend money for organizing meetings, receiving outside people and also traveling to represent farmers' concerns to the authorities. However, on the other hand, there have been serious concerns regarding potential control on water resources by powerful elites and large landholders, particularly in Pakistan and Bangladesh. Further, the representation of the poor farmers in the management committees of the new organizations is generally marginal in the South Asian systems studied.

9. ***Successful implementation, effectiveness and pro-poorness of institutional reforms in irrigation depend upon a range of conditions***. Our field-work-based cross-system and cross-country comparisons show that reforms are likely to be relatively more successful, effective and pro-poor where:

a) Landholdings are fairly equitably distributed, and household holdings are not excessively fragmented and scattered.

b) Socioeconomic differentiation among users or groups of users is less, and communities within systems are fairly homogenous, e.g., not divided historically into caste systems.
c) Irrigated agriculture is profitable and benefits of irrigation to farmers are significant.
d) There are incentives for managers and management organizations to improve on service delivery, commercial orientation of management and accountability mechanisms are in place.
d) The cost of canal irrigation is fairly high, i.e., farmers incur higher cost in irrigation charges.
e) Systems are relatively small and more manageable.

In systems, where these conditions do not hold, it will take a relatively longer period of time before reforms can be successfully implemented with significant positive outcomes for communities, including the poor. Enforcement of strict regulatory measures will remain crucial to avoid any negative impacts on the poor.

Most of the above conditions except the last (e) hold for Chinese canal irrigation systems where land and water distribution is highly equitable, socioeconomic differentiation is relatively less, productivity of most irrigated systems is fairly high, and there are incentives for managers and service providers. The comparative analysis of traditional collectives and emerging non-collectives shows that if managers are provided with positive incentives to earn money by saving water, they improve service delivery and overall water management. While water management with incentives reduces water delivered to farmers due to improved water use efficiency, it does not have any negative impacts on farmers' output, farm income and poverty. Some of these conditions also hold in Vietnam where IDMCs have been set up as business entities and are required to be financially self-reliant, that is, to recover their own operating costs through user fees and other subsidiary income. (However, there are issues in relation to their effectiveness as these are owned by the state, but set up as for-profit enterprises; policies and regulations require them to provide a public good regardless of financial returns; thus they are restricted in their abilities to administer government and private-sector tools. These institutions lack autonomy both financially and administratively, and also lack incentives. Also, the accountability structure is divided between administrative and irrigation management institutions. Sub-institutions are accountable to the administrative unit they belong to and to the higher irrigation-management institution, creating an ambiguities in overall management). In both China and Vietnam, the issue of household land fragmentation may pose some difficulties in effective functioning of water user groups, especially in those settings where scattering of household land plots will require them to be members of more than one user group.

As a whole, it can be said that China and Vietnam are on one side of the spectrum of the above conditions, Indonesia and India are somewhere in the middle, and Bangladesh and Pakistan are on the other side of the spectrum where inequities in land and water distribution are high, socioeconomic differentiation among water users is significant, inequity in community power structures is huge, productivity of agricultural systems is low, cost of canal irrigation to farmers is also low, and incentives and accountability mechanisms are weak or lacking.

10. ***In the long term, water user organizations may be successful if they are multifunctional with commercial orientation!*** Newly created organizations of water user groups in all the studied systems are single-functional, i.e., irrigation /water management (except for Cooperatives in Vietnam that, in addition to local-level water-management services, also carryout other related activities, such as farm extension, crop protection, land preparation, electricity and water-management services). In the initial phase of reforms, these organizations may be functional due to financial incentives given to them in the form of grant funds for carrying out necessary activities. However, in the long run, their continued functioning and sustainability and members' participation will depend on the type of incentives the mangers and members receive, and this is particularly so in South Asian systems which are on the other side of the spectrum of conditions less conducive for successful implementation and effectiveness of reforms in the short run (as discussed above).

While managers can be provided financial incentives through improved levels of charges and cost recovery, participation of general members will depend on the incentives and overall benefits they derive from their participation. The likelihood of sustainability of these organizations and their success may be enhanced if they are made *multi-functional with some commercial orientation* (*like emerging farmer companies [FCs] in Sri Lanka), where a company carries out activities related to system O&M and management and implement commercial activities to help farmers to improve their incomes. The farmer company in Ridi Bendi Ela irrigation system, established in late 1990s, carries out five activities: a) repair and maintenance of the canal system below the sluice as a contractor of the system-level farmer organization (SLFO) created by federating 11 farmer organizations; b) supply of fertilizer to shareholders on credit; c) cultivation of seed paddy by selected farmers; d) marketing of poultry; and e) cultivation of passion fruit. The farmer company initiative in Ridi Bendi Ela and the other nine farmer companies promoted by the Irrigation Management Division in Sri Lanka represent an important institutional experiment not only in irrigation management but in developing smallholder irrigated economies. Though it is early times yet to conclude, the results of the FC's work so far are impressive and offer promise. The FC has created value for the farmers, and the initial financial results show promise of early viability. The unique features of this initiative are that it is based on commercial principles, and offers a total package of services including services related to irrigation.* More fieldwork and action research is needed on understanding the potential *multi-functionality* of water user groups, to explore how these groups in our study countries could be made *multifunctional*, and what would be their implications for the poor.

11. ***Sequencing of activities, incentives, and effective leaderships are keys in early period of reform implementation.*** Some other lessons learnt from the early period of reform implementation include the following:

a) Initiation of irrigation-sector reforms and their implementation have been the outcome of one or more of the following four factors: external donor pressure, internal financial pressure and emerging crises in water sector, internal political motivation and/or commitment;

b) The complexity, effectiveness and success in implementing reforms vary across levels —from policy development or change to development of laws and regulations, implementation plans, development of or change in institutions, and on-ground implementation of reforms. The level of complexity increases towards lower levels, i.e., towards on-ground implementation of reforms; development of policies and laws is relatively easy (in almost all study countries water policies were formulated in a relatively short period), however, their actual implementation is not so easy;

c) The sequencing and prioritization of reform activities are very important, certain activities must be done before other activities, i.e., implementation of irrigation charge policy aimed at increasing charge level and rate of collection may not be effective unless service delivery to farmers is improved. In establishing new management organizations, a mixture of both top-down and bottom-up approaches is generally effective.

d) In the initial phases of reforms, incentives to stakeholders at all levels including policy, management and farmer level are important for reform implementation, i.e., grants to FOs have provided them incentives to form organizations to remain alive and be functional.

e) Good leadership and catalysts at all levels are also key to effectively implement reforms.

d) Overall, institutional reform is a slow process, and it becomes very slow where the above factors are not favorable.

12. ***Reforms should not be delayed even where major benefits to the poor are not visible in the short term***. The overall conclusion is that, so far, reforms have been implemented only partially in terms of spatial scale, i.e., coverage of systems, organizational structure, i.e., tiers of new management structures and management functions, i.e., infrastructure management vs. water management. Given the time period of reforms and scale of coverage, it is too early to assess the full range of impacts of reforms. However, early indications are that reform initiatives have led to improved irrigation performance and water use efficiency, increased productivity and farm incomes, and the poor have benefited both directly and indirectly. The irrigation-sector reforms can be regarded to have important pro-poor aspects. The study suggests that the reforms should not be delayed even if benefits to the poor are not very visible in the short run, and efforts be made to make them pro-poor as suggested above and further discussed in recommendations section below.

Table 3.5 Implementation progress and effectiveness of institutional reforms in the irrigation sector.

Country	Reform progress and effectiveness
India	In India, a major intervention strategy attempted starting with AP in 1997 and MP in 1999 was the introduction of PIM and handing over management of irrigation to the FOs. Reforms in these states have focused on: a) the introduction of a suitable policy and legal framework; b) formation of WUAs across all types of irrigation systems in the state; c) implementation of large-scale training programs for farmers and staff of the irrigation department; d) bringing in significant financial reforms to influence quality performance of users' organizations. Today, the state is leading the irrigation reforms in India. Major steps are focused on institutional reforms towards IMT in all over the state. In this connection, the state has formed 10,292 WUAs and 174 distributary committees. While the introduction of PIM in both the states (although AP has completed 5 years) is relatively new and as such it is perhaps too early to assess its impact on the irrigation system performance, early assessments suggest that the outcomes are mixed. Data gathered from fields indicate that the introduction of PIM did have a positive impact on the irrigation system performance. Data from both the states suggests that after the introduction of PIM water flows faster to the lower reaches and covers an increased area. In AP, productivity of major crops such as paddy, sugarcane and maize is reported to have increased by 926, 2,470 and 1,235 kg/ha during the post-reform period from 1997-98 to 2000-2001 largely due to improved availability of water for early sowing, and improved reliability of water supplies. The overall quality of O&M works has improved with greater cost-effectiveness. The O&M works undertaken after the implementation of PIM have generally benefited small landholders more than the large farmers by creating more opportunities for agricultural wage earning. Reforms have also led to a reduction in disputes mainly related to water distribution to the fields to an extent of over 15 percent. Many of the small farmers felt that after the IMT, some forum is now available to approach for redress if required. In MP, farmers have strategically elected large and powerful farmers as presidents from tail-end reaches to ensure that water reaches the tail end. In MP, the choice of generally large and influential people as presidents was driven by the desire of farmers to have some one strong enough to negotiate with irrigation agency and outsiders. Further, such people are believed to have the capacity to spend money for organizing meetings, receiving outside people and also traveling to represent farmers' concerns to the authorities. On the other hand, the field work shows that reforms have been focusing on maintenance than on water regulation and improving water use efficiency and productivity. Activities like allocation plans, water budgeting and efforts to use water efficiently and equitably were missing in the WUA functions. None of the WUAs could generate additional funds from the water users apart from the funds given by the government except in KDS. The tail-end villages (WUAs)and some DC were said to have collected money to supplement government allocations for clearing of drains in the early phases of IMT implementation.Though empowered no WUA has taken penal action against earning by defaulting members. It is also opined that some WUA presidents and DC presidents are

	operating more like contractors forming an unholy nexus with irrigation officials and competent authorities. High-caste domination is shown among MCs of WUAs both in AP and MP. Further, the representation of poor farmers is marginal in both states.
Pakistan	In Pakistan, IMT was initiated at Hakra-4R distributary, which was the first and the largest pilot project implemented in the country. Under the newly formulated Punjab Irrigation and Drainage Act of 1997, Hakra-4R was handed over to farmers in May 2000, and since then (FOs) have been managing the distributary (secondary level) and WUAs managing the watercourses (tertiary level).The system is being managed through participation of farmer members and their elected representatives. Our performance assessment of the system indicates that irrigation charges have been increased in the system, service delivery has improved, irrigation infrastructural condition and its management have also improved, overall performance of the systems in terms of equity in water distribution, access to water by tail enders where there is more poverty, cropped areas and cropped productivity have also improved. As shown in table 5, after the transfer of management to the FO and improvement in service delivery, irrigation charges were increased, collection rate improved and total revenue collection increased by about Rs 1 million. This resulted in more funds available for O&M of the system. Infrastructure of the distributary was improved, including adjustments of outlets, desilting, strengthening of banks, and other repair work. Along with infrastructural management, irrigation water management/distribution was also improved. These factors led to increasing water delivery performance and overall system efficiency as shown in table 3.6. Increased overall water availability and its improved access have resulted in increased crop area by around 6 percent from 25,614 hectares to 27,115 hectares. More importantly, distribution of water improved significantly with the head-tail equity ratio of around 1. Among the distributaries studied, equity performance of Hakra-4R was the highest. Head-tail equity ratio for other distributaries studied in Punjab ranged from 1.23 to 2.50, indicating significant inequity in water distribution. With improved service delivery, availability, reliability and access to water at the tail ends have improved significantly. Empirical evidence shows that there is more incidence of poverty at tail ends of Hakra-4R, and that the poor farmers have benefited from this improvement. During farm-level surveys, 43 percent of poor small farmers at the tail ends indicated that they have benefited from the improved service delivery and resulting improved system performance. Overall, 63 percent of farmers showed satisfaction in terms of receiving their due share of water. Other benefits included reduction in water theft as indicated by 81 percent of the respondents, reduction in litigation cases related to irrigation water and rent-seeking by irrigation officials. On the other hand, there have been concerns regarding control by larger landholders and influential people who have promoted nepotism.

Table 3.6: Impacts of improved service delivery in Hakra-4R, Punjab, Pakistan.

Indicator	1998 (before transfer)	2002 (after transfer)
Water charge (Rs/ha)	175	199
Total revenue collection (Rs million)	4.49	5.40
Water delivery performance*	0.91	1.04
Overall system efficiency**	0.47	0.52
Cropped area (ha)	25,614	2,7115
Head-tail equity	Not available	1.09
Farmers' response		
- increased benefits at the head (%)		40
- increased benefits at the middle (%)		38
		43
- increased benefits at the tail (%)		41
- overall satisfaction (%)		

* Water delivery performance is defined as the ratio of actual to target volume of water delivered.

** Overall system efficiency is defined as the ratio of annual crop water requirement to the total inflow into the canal system with 40 percent losses.

Overall, 63 percent of farmers showed satisfaction in terms of receiving their due share of water. Other benefits included reduction in water theft as indicated by 81 percent of the respondents, reduction in litigation cases related to irrigation water and rent seeking by irrigation officials, improved assessment of water charges, and increased information-sharing among farmers. On the other hand, there have been concerns regarding control by larger landholders and influential people who have promoted nepotism. The experience in Hakra-4R suggest that IMT has created an environment conducive to improved management of irrigation. However, there are certain issues, such as continuing conflict between FOs and the irrigation department, and potential conflicts among communities along the systems, that need to be addressed. Whether the Hakra-4R model can be replicated at a broader level is still a big question. In the PPAs, communities were consulted on this issue, and the response was mixed. The communities strongly suggested that, since there is significant inequity in land distribution and that the society is divided into classes and castes, strict government regulation and laws, along with their effective implementation, will be crucial to successfully implement the current reforms at the broader level.

Bangladesh

In the mid-1990s, Bangladesh initiated institutional reforms for improving performance of irrigation systems. The reforms focused on increasing users' participation in the irrigation management, including infrastructural maintenance and water allocation. A three-tier structure was introduced: water management groups (WMGs) at the lowest level/tertiary/outlets, a WMG consists of nine members: one-third each from large, medium and small farmers' water management associations (WMAs) consisting of 10-15 WMGs at the middle/secondary level of systems, and water management federations (WMFs) at the apex level of a system. These were expected be working in close

	cooperation with BWDB. However, progress in formation and development of these water user groups has been very slow, and in many areas these groups are yet to be formed. In the Pabna irrigation system, for example, there are 365 WMGs of which only two have been registered with the government. Where these groups have been formed, outcomes in relation to their effective functioning and performance impacts are mixed. In G-K, the formation of WMGs and WMAs has led to improving maintenance of irrigation infrastructure and water distribution in some areas. Most of the WMG members interviewed were of the opinion that the existing WMG committees were not effective and that new committees needed to be properly constituted for effective contribution to efficient O&M of the irrigation systems. Water user groups have not been involved in assessment or collection of water charges or in spending of revenues; these functions are still being performed by the BWDB. The overall conclusion is that the existing water management groups and associations (WMGs and WMAs) are not yet fully active and functional in all areas, even in the long-standing G-K project, and the systems continue to be managed by the public-sector agencies. User groups are still at early stages of operation or in the formation in different parts of the system. Steps need to be taken to make these organizations more effective and functional. The detailed guidelines for PIM are available, but they have not been effectively implemented. In PRAs, it was brought out that the user groups are capable and willing to take responsibility for managing the systems provided they are handed over systems in good running condition, given legal support by law enforcement agencies, technical support and training by the agencies, and authority to assess and collect irrigation service charges. Given the prevailing inequity in land distribution in the systems, there are concerns relating to dominance of local influential people and large landholders in user groups. There are three unique specific pro-poor initiatives in large- and medium-scale irrigation systems: Labor contracting societies (LCS), Embankment Maintenance Group (EMG), Channel Maintenance Group (CMG). The Labor Contracting Society (LCS), known as the Landless Contracting Society aims at providing employment and income-generating opportunities to the rural people, both men and women, and ensuring fair wages and achieving high quality of construction work. At least 25 percent of the earthwork of any public water project/subproject/scheme is supposed to be reserved for the LCS. Preventive maintenance of embankments is an integrated component of O&M and aims at maintaining their crests and slopes in an optimal physical condition. Preventive maintenance is executed through the Embankment Maintenance Group (EMG) throughout the year. The canal maintenance group (CMG) also follows similar guidelines as EMG.A certain portion of main and secondary canals would be maintained by a women's group facilitated through an affiliated agency. The affiliated agency is in charge of the recruitment of female laborers willing and capable of engaging themselves in an EMG/CMG for a period not shorter than 6 months. Priority would be given to Female-Headed Households (FHH). Channel Maintenance Groups (CMGs) are in place in the Pabna system and Embankment Maintenance Groups (EMGs) are operating in the G-K system. In both systems, the majority members of both EMGs and CMGs are vulnerable

	women. In addition to earning from wage labor, women are using the slopes of the canals and the embankments to harvest vegetables thereby adding extra income.
China	In China, IMT and farmer participation in irrigation system management, or PIM, has been one of the key components of the reforms initiated in the mid-1990s. WUAs were first piloted in projects in the Hubei Province Yangtze Basin Project (1994-2000). Management was transferred to farmer "water user" groups, with responsibility for local irrigation distribution networks. These formed part of a new concept - Self-Financing Irrigation and Drainage Districts SIDDS. SIDDs are implemented through water supply corporations (WSCs) and water user associations (WUAs). The WSCs and WUAs replace existing diverse authorities, such as local water resource bureaus, water management stations and townships. The WSCs operate and maintain reservoirs and branch canals, with the aim of providing and regulating water supplies to farmers grouped in WUAs. WSCs, owned and funded by water users, sell water to WUAs based on equitable and accurate standards, aiming at recovery of capital and operating costs. Water is purchased according to the number of cubic meters used, and the WSC measures water deliveries at the WUA at the lateral head. Water deliveries to the WUAs by the WSC are regulated by water sales agreements between the two parties, specifying the rights and responsibilities of both. Because water deliveries are charged by volume, farmers in the WUAs have an incentive to use water more efficiently and less wastefully. WUAs collect water charges from their members and buy water from the WSC for their members, based on water demand. WUAs are responsible for the design, construction, maintenance and management of water delivery at the farm level. They are registered as legal entities, and can contract, lease or auction the operation of canal maintenance. Thus far, in China, approximately 250 WUAs and 17 WSCs have been established in 8 provinces. They have been supported by the Ministry of Water Resources,[3] and the current drafting process for the new Water Law is seeking ways to further extend their introduction and operation. There is a varying degree of success in implementation of reforms and their effectiveness. In the study area, three patterns of surface-water management are identified: a) *Collective Management*, where village leadership is responsible for irrigation management, b) *WUA Management*, farmer-based participatory management, and c) Contact-based management, where village leadership establishes a contract with an individual to manage the village's water. Filed data show that since the early 1990s and, especially after 1995, reform has successively established WUAs and contracting in the place of collective management. In some regions, non-collective management forms have even become the dominated pattern. The major difference between a non-collective and a collective is the incentives given to managers under the non-collective system. Water managers in some communities are given incentives to save water as if the actual quantity of water delivered to the village at the request of the water manager is less than the targeted quantity; the difference between the volumetric fee that is collected from the farmers and that which he pays for the water is his *excess profit*. The excess profit is an amount that is earned by the manager beyond the fixed payment.

[3] See July 28th 2000 Policy Circular of the Ministry of Water Resources to Provincial Water Resource Bureaus.

	The study analyzed the implications of three management patterns for the poor. The study results show that if managers are provided with positive incentives to earn money by saving water, they will try to improve water management; water delivered to farmers will be significantly reduced. However, while water management with incentives will reduce water use, it will not have any negative impacts on farmers' output, farm income and poverty.
Indonesia	Under the reforms, implementation of IMT was initiated gradually in four provinces in Java, namely West Java, Central Java, Yogyakarta and East Java. During the first phase of IMT implementation, in large and medium scale several systems were transferred in 1999. In Yogyakarta, these included two of the six schemes namely, Papa and Pengasih in the Kalibawang system. In central Java, two systems, namely, Krogowanan in the Magelang district and Beton in the Wonogiri district were transferred in 1999. In phase - II, other four systems in the Magelang district, i.e., the Sidandang, Kajor Semendi, Pasekan and Sumberan, were transferred in 2001, and the remaining four schemes in the Kalibawang system were transferred in 2002. In the transferred systems, the organizational structure consists of two or three tiers, depending on the size of systems: WUA at the tertiary level, WUAF at the secondary level, and a group of WUAFs at the system/primary level. In general, WUAs and WUAFs manage the respective levels of system up to the secondary level, and public agencies manage the primary level of the systems. Field works show there are significant differences in the implementation of management transfer and in the establishment, functioning and effectiveness of WUAs across systems and locations. Management transfer has led to improved system performance. Performance indicators such as farmers' participation, water distribution and infrastructural maintenance, ISF collection and cost recovery and water-related conflicts have improved after transfer, and these indicators are generally better in transferred Kalibawang and Krogowanan systems than in the non-transferred Glapan and Kambu Kiri systems. Among the transferred systems, performance is relatively better in the water-adequate Kalibawang system than in the water-abundant Krogowanan system. Transparency and accountability in O&M expenditure between the government and farmers has led to the improvement in irrigation management performance through improvements in cropping intensity, irrigated area, equity in water use, farmers' participation in irrigation management, and conflict reduction. However, there are concerns that most newly established WUAs still operate under power structures of village leaders and government officials. Overall, while early indications are that management transfer has generated positive results there are certain issues that need to be resolved, such as improvement in water structures and capacity building of water uses. Further, the study suggests that a) there are clashes of interests among various departments dealing with irrigation and agricultural departments, settlement department and the regional department; b) irrigation management at the system level is still centralistic; and c) the mechanism of giving authority to farmers, as in the new law, is not fully effective.
Vietnam	The Vietnamese government initiated institutional reforms in the water sector, including irrigation, in the mid-1990s. The focus in the reforms has been on four key areas: a) decentralization, b) privatization, c) financial autonomy, and d) farmer involvement in

	management. Decentralization has been initiated through devolving to the provinces major responsibility for water-resources development, improvement and management, while at the same time consolidating, at the provincial level, power previously lodged with administrative districts. The management of irrigation and drainage systems is divided into two levels. The system-level is managed by state companies (IDMCs). The farm level is managed by the Cooperative. For the management of an entire irrigation and drainage system, the organizational structure is from the principal IDMC to the subsidiary IDMC or enterprises, to the O&M field stations and finally to the agricultural Cooperatives. Most IDMCs consider their role to include a) providing irrigation water, b) collecting irrigation fees, and c) maintaining irrigation facilities. IDMCs are expected to operate as businesses and to be financially self-reliant, that is, to recover their own operating costs through user fees and other subsidiary income. At the system level, the issue of cost recovery remains a sticking point with managers reluctant to raise water fees and users reluctant to pay higher fees. The situation remains that collected water fees do not fully cover costs. This is despite very high collection rates in the studied systems (95 to 99%). The water fee remains the main source of revenue for the IDMCs. The strengths and weaknesses can be put into three broad categories of operations, finances, and farmer participation/pro-poor. The operational aspects of IDMCs are generally fairly strong as management of whole irrigation systems for bulk deliveries to commune-level facilitates more effective management by not taking responsibility for micromanagement needs below the commune level. The planned delivery schedule is based on actual projected needs and is flexible. However, weaknesses with operations relate to IDMCs' current legal status. The IDMC is a public company registered as a state-owned enterprise. The IDMC lacks authority to apply strict enforcement measures and lack autonomy to apply strict market measures. The IDMC must rely on soft- policy approaches to foster compliance. The delivery schedule is a general plan, but it is not binding or strictly enforced, especially the aspect of timeliness. The IDMC has little control against illegal withdrawals and unauthorized structural modifications made by people illegally taking water. Another aspect that can hinder operations is that the systems often lack water- storage infrastructure which prevents the IDMC from responding adequately to changing demands. Often, the IDMC responsibility does not extend to the Cooperative, leaving a large portion of the secondary canal in a sort of "no man's land" with the result that no one is in charge of O&M in this area. In relation to the financial aspects, the main strength is high collection rates for irrigation fees (85-95%) in the study areas. The weaknesses include the fact that the water fee is set by the provincial government and not by the IDMC. This creates a gap between the actual fee and the actual costs of providing an irrigation service. Electricity costs are a substantial portion of annual expenses and payment is due in a time not consistent with the collection of irrigation fees and harvesting. The IDMC relies on government subsidies to

	fully meet expenditure requirements. Currently, irrigation fees are insufficient to cover costs. In regard to the farmer participation and pro-poor aspects the main strengths of the IDMC are that the water-delivery schedule can be flexible depending on cropping patterns. Additionally, the delivery schedule often favors disadvantaged areas, such as high-elevation or tail-end areas. In cases of severe drought, the IDMC will waive irrigation fees to protect the livelihoods of the affected farmers. The main weaknesses in relation to farmer participation and pro-poor aspects include a lack of compliance with IDMC's management practices where good communication with on-farm water managers does not exist. Due to the bureaucratic and incentive structure, the IDMC may not have a direct link to farmers hindering effective management as the Cooperatives must protect their economic and political positions. The Cooperatives also have a number of strengths and weaknesses. The strengths of the Cooperatives regarding operations include that when effective, the Cooperatives provide an institution that can maintain control, so that irrigation does not become an open-access resource at the local level. Legally, the Cooperatives have the power to make contracts with the IDMC. In some case, such as in Nam Thach Han, the water fee is set during annual meetings between the Cooperatives and IDMC, based on actual expenditures. In some areas, a self-monitoring process has been developed to verify actual water use and prevent wasteful or illegal water practices. Water-management responsibilities are often divided at the village level, which is a strong traditional rural community unit. Some places, such as Tri Qua, possess clear guidelines to resolve conflicts, such as what type of land gets priority in water delivery. The strengths of the Cooperatives regarding participation and pro-poor aspects include that the Cooperatives have a tradition of providing service to farmers at the local level. In Nam Thach Han, Cooperatives are at the village level, which strengthens farmer involvement. The Cooperative irrigation team communicates directly with the farmers. Finally, arrangements during times of drought allow the Cooperative to take quick action in the interest of protecting farmers, but before official approval from the provincial DARD can be obtained. However, Cooperatives' effectiveness is weakened where water supplies are unreliable or insufficient and there are limited off-farm income opportunities. Regarding the financial situation of Cooperatives there are mainly weaknesses, which include irrigation fees going into the Cooperative's general funds and may not be put back into irrigation services. The current financial arrangements lack sustainability. In some areas, the Cooperative has been separated from the commune, which has lowered salaries and diminished the Cooperatives' role. This also makes it more difficult to mobilize farmers in helping with maintenance. Overall, there are two primary problems with the irrigation-management structure in Vietnam. The first problem is that the accountability structure is divided between administrative and irrigation-management institutions. Sub-institutions are accountable to the administrative unit they belong to and to the higher irrigation-management institution. The IDMC, however, is responsible for the entire system management and accountable to the Provincial or District People's Committee. This can create serious ambiguities as to

	how the irrigation management is to be handled. This problem is exacerbated with commune-level agricultural Cooperatives. The Cooperatives must serve the interests of the commune and handle multiple services with varying degrees of financial return).The financial arrangements are a further complication of this problem. Institutions lack the proper incentives to pass along fees accurately to higher institutions. Moreover, some individual institutions may not hold irrigation fees for the provision and maintenance of irrigation services. A well-entrenched system of government subsidies prolongs this situation. The second major problem in irrigation management concerns the status of irrigation institutions. Irrigation institutions are owned by the state, but set up as for-profit enterprises. Policies and regulations require them to provide a public good regardless of financial return. Thus, they are restricted in their abilities to administer government tools and to administer private-sector tools. These institutions lack autonomy both financially and administratively. Irrigation management institutions in Vietnam lack the incentives and the ability to improve their situation.

Other Major Findings

1 ***Agricultural diversification towards high-value enterprises and crops enhance the value of irrigation water and reduce poverty significantly.*** Diversification of crops and agricultural enterprises are found to significantly enhance benefits of access to irrigation by farm households with positive influence on farm incomes. The study finds that crop and income diversification significantly reduces incidence and severity of poverty, and that there is a significant inverse relationship between these variables. One of the major reasons for poor system performance of particularly large-scale irrigation systems in Bangladesh, India, Pakistan and Indonesia is lack of crop and agricultural enterprise diversification. Country-studies strongly suggest that farm enterprises, both cropping and non-cropping, should be diversified towards high-value and high-return enterprises through development and promotion of agricultural diversification approaches and technologies.

2. ***Value of irrigation water is many times more when all direct and indirect broader- level benefits of water are accounted for***: Value of irrigation water varies significantly across countries and systems. For Indian systems, average monetary value of water varies from US\$0.04/m^3 to 0.17/m^3. In Pakistan systems, the value varies from US\$0.004/m^3 to 0.13/m^3. In the Chinese systems, value estimates vary from US\$0.02/m^3 to 0.22/m^3, and for Vietnamese systems, value of irrigation water varies from US\$0.045/m^3 to 0.38/m^3. These are, however, direct productivity-related benefits of water. When other benefits and dimensions are also accounted for, the value of irrigation water is many times more than the direct productivity benefits. The study highlights four key dimensions of irrigation water value—time, space, use and impacts. The value of water in terms of direct and indirect benefits of only crop productivity is only around half of that when other benefits, such as those derived from growing orchards and trees, rearing livestock and fisheries, are also accounted for. For example, in Pakistan, the value of irrigation

water increases from US$0.04/$m^3$ in terms of productivity-related benefits to US$0.12/$m^3$ when benefits from other uses of water are also accounted for—at the local level. The local-level value estimates a further increase to US$0.24/$m^3$ when social benefits of poverty reduction are also accounted for. These local-level estimates increase to US$0.48/$m^3$ when all major direct and indirect economic and social benefits are accounted for at the national level. Therefore, the study suggests that the value of irrigation water is not as low as it is generally estimated or perceived when all major uses and impacts of water are properly accounted for. Further, the results suggest that the value of irrigation water is increasing, not only because of increasing scarcity of water but also because of increase in the share of high-value farm enterprises, such as high-value crops, livestock and fisheries. The study suggests that in low water value agricultural regions, efforts should be made to enhance value of water by promoting less water-consuming high-value enterprises.

3. ***Resource-conserving technologies enhance value of water and returns to farming***: The study results, for Indian and Pakistani systems, suggest that small-scale cultivation and resource conservation technologies, such as the bed and furrow method, zero tillage technology and precision land leveling, lead to water saving by 20-30 percent, labor saving by over 30 percent and crop yields increase by 15-20 percent—these factors reduce cost of production and improve returns to farming. However, so far dissemination and adoption of these technologies remain very limited, scattered and patchy. If disseminated and adopted on a wider scale, enormous gains can be achieved in aggregate water-saving and productivity increases. The studies suggest that effective dissemination of existing resource-conserving technologies and the development of new technologies should be promoted to enhance the benefits of available irrigation water resources.

4. ***Agricultural productivity and value of water to the poor can be enhanced with delivery of services through integrated approaches with public-private sector partnerships.*** The study results indicate that major causes of low agricultural productivity, particularly in South Asian systems, besides land and water management factors as discussed above are a) farmers' lack of access to good-quality basic inputs such as seeds, fertilizers, and chemicals when necessary, b) low awareness and lack of access to production-enhancing technologies, and new methods of cultivation, c) lack of access to needed information, new techniques, necessary crop protection measures, prices and markets, d) lack of access to finance (credit), and e) problems related to output marketing. If the above constraints are removed, there is considerable scope to increase agricultural productivity with significant impacts on poverty. There is evidence that performance of the public sector in the provision of key inputs or services has been disappointing, where access to the services have been limited mostly to large farmers and the nonpoor. In this regard, there are four basic concerns:

   a) New information, technology, production inputs, finance and other services are often available but not necessarily accessible by a large number of farmers, especially poor small farmers, when and where they are needed, so the issue is not so much of availability but of access to these factors and services.

b) Institutional mechanisms that can help provide access to these factors and services sometimes do not exist or if they exist, they are often fragmentary, of poor quality, limited in capacity or scope and often inefficient, exploitative and antipoor.

c) Transaction costs of both providing and accessing these services when provided in an uncoordinated manner by the public-sector agencies are often very high.

d) There is a need for institutional mechanisms that i) ensure delivery of these services on a wider scale, ii) provide services in an integrated manner so that transaction costs of service provision as well as transaction costs of accessing these services by farmers are reduced, iii) ensure transaction costs of monitoring and quality control are low, and iv) ensure there are strong incentives for service providers.

The review of international best practices in service delivery indicate that the effective initiatives are those that a) embrace a partnership approach; b) integrate a number of different services under the same roof, or through joint-operating procedures; c) demonstrate innovative solutions for commonly recognized problems; and d) can be transferred to other localities and cultures. The concept of integrated-services provision (ISP) in the agriculture sector, through public-private-sector partnerships, has not been promoted as an alternative to public-sector provision of these services. However, over time, various ISP type experiments have been carried out or similar ideas and initiatives have emerged spontaneously, though mostly at a smaller scale. The review of various case studies and examples of various models, initiatives and practices from Pakistan, India, Sri Lanka, China, sub-Saharan Africa and other countries, gives indications that farmers' access to these factors and services can be improved through their provision in an integrated manner with public-private-sector partnerships. One might also explore the option of using WUAs as vehicles for delivery of key inputs and services as also hinted above. However, in order to recommend an effective approach to service delivery in agriculture in the study countries, more in-depth research is needed on various initiatives and models, their functioning, institutional arrangements, and their successes and failures.

Chapter 4

Pro-Poor Intervention Strategies in Irrigated Agriculture

Conclusions, Recommendations and Guidelines

The previous chapter presents synthesis of findings, conclusions and their implications based on multi-country comparative analyses, highlighting the realities, major issues and key problems, their implications for the poor, and indications of the potential solutions. This chapter further synthesizes the broad conclusions of the study, discusses broad approaches and strategies to addressing the identified problems, and suggests specific interventions, actions and guidelines for moving forward.

1. ***In South Asian irrigation systems, poverty is high among households and communities that are poor in land, water, productivity and education but rich in unskilled labor, and inequity in distribution of these resources is the principle cause of poverty.*** The findings of the study confirm that the incidence and severity of poverty are significantly high in rain-fed and marginal areas compared to those in irrigated areas. However, despite the huge investments made in irrigation development and management and the fact that irrigation reduces poverty, many irrigation systems continue to be homes to a large number of the poor, where poverty incidence varies from 6 percent to 77 percent. Irrigation systems in South Asia have a much greater proportion of population suffering from poverty compared to that in Southeast Asian and Chinese systems. Poverty in these systems is high among households and communities that are poor in land, water, productivity and education but have large-size families and unskilled labor. Inequitable distribution of these key resources is the principal causes of poverty in these systems.

2. ***Irrigation can be strongly pro-poor, neutral or even antipoor depending on a range of conditions***. Impacts of irrigation on poverty vary from very high to very low or even negative, and irrigation investments do not automatically reduce poverty. ***Irrigation can be strongly pro-poor, pro-poor, neutral or even antipoor depending on a range of conditions including: a) condition of irrigation infrastructure and its management, b) irrigation water allocation and distribution procedures and practices, c) access to modern resource-conserving and production technologies, cropping patterns and crop diversification, and d) support measures, e.g., information, input and output marketing, and e) access to land, its distribution structure and its quality.*** Where these conditions are relatively favorable as, for example, in many Chinese systems, irrigation has strong antipoverty impacts and vice versa.

3. ***There are indicative patterns of poverty in most South Asian irrigation systems***. In the South Asian irrigation systems, poverty is high in locations where access to canal water is less such as in tail-end areas in most cases, groundwater quality is poor, access to employment opportunities in the nonfarm sector is limited, and small and marginal farmers have low productivity due to constraints in accessing key production inputs and services. So there are indicative patterns of poverty in the systems. Accounting for

differences in groundwater quality, effective canal-water reallocations to areas with little or no access to good-quality groundwater can significantly increase farm incomes, implying that there is a need for conjunctive management/use of surface water and groundwater.

4. ***South Asia has only partially benefited from past investments in irrigation.*** Performance of irrigation systems is strongly linked to poverty; systems with poor performance have a larger proportion of population under poverty and vice versa; and this situation characterizes most systems in South Asia, especially in Pakistan and Bangladesh. In these systems, lack of adequate funding, inefficient spending and nonincentive-based poor management/institutional arrangements are fundamental causes of poor irrigation performance. There is tremendous scope for improving irrigation through effective interventions in these areas.

5. ***Low level of irrigation charges applied uniformly to all socioeconomic groups hurt the poor more than the nonpoor.*** The low level of irrigation charges, coupled with defective charging structures and inefficient collection and spending mechanisms leads to poor irrigation system performance, which reduces overall availability and access to water, hurting the poor, small and marginal farmers and those in downstream areas much more than the nonpoor. Irrigation charges are much lower in South Asian systems than in Southeast Asian systems. Further, in the former systems charges are not linked to service delivery. The low level of charges creates disincentives for farmers and service providers, weakens accountability linkages, and leads to the vicious circle of poor system performance.

6. ***Successful implementation, effectiveness and pro-poorness of institutional reforms depend upon a range of conditions***. Institutional reforms in the irrigation sector, such as PIM and management handover have led to improved maintenance, increased crop productivity, reduced inequities in water distribution and increased funding, but the full range of impacts remains to be seen. The reforms have also benefited the poor through enhanced employment opportunities in O&M works, improved equity in water distribution and access to water at tail ends and through reduction in water-related disputes and other similar aspects. However, if issues related to local power structures are not accounted for in reform implementation, they could be potentially disadvantageous to the poor. The reform implementation is more likely to be successful, effective and pro-poor where: a*)landholdings are fairly equitably distributed, b) socioeconomic differentiation among users or groups of users is less, and communities within systems are fairly homogenous, c) irrigated agriculture is profitable and benefits of irrigation to farmers are significant, d) there are incentives for managers and management organizations to improve on service delivery, and commercial orientation of management, and accountability mechanisms are in place, and d) cost of canal irrigation is fairly high, i.e., farmers incur higher costs in irrigation charges.* Where such conditions are not favorable, it will take a relatively longer period of time for reform initiatives to be successful and effective.

7. ***Agricultural-enterprise diversification, resource-conserving technologies, and integrated approaches to service delivery in agriculture enhance benefits of irrigation to the poor***. The study findings suggest that value of irrigation water is not as low as it is generally estimated or perceived, and the value of irrigation water is 10-12 times more when all direct and indirect broader-level benefits of water are accounted for. Agricultural diversification towards high-value enterprises and crops enhance the value of irrigation water and reduces poverty significantly. Resource-conserving technologies, such as bed and furrow method, zero tillage technology and precision land leveling enhance value of water and returns to farming by 20-30 percent. Agricultural productivity and the value of water to the poor can be enhanced with delivery of services through integrated approaches with public-private-sector partnerships.

Finally, we identify some examples of good (or with good potential) conditions, institutions, management practices and initiatives for each of the six countries that have important pro-equity, pro-poor, and pro-market aspects (table 4.1).

Table 4.1 Examples of unique/good/pro-poor (or with good potential) conditions, institutions, management practices and initiatives.

Country	Examples of good (or with good potential) conditions, institutions, management practices and initiatives.
China	• Distribution of farmland to landless, and overall equity in land distribution brought through effective land reforms. • Equity in water distribution across farms and across upstream and downstream reaches. • Decoupled land and water rights. • Relatively more investments in downstream of irrigation systems compared to upstream areas. • Initiation of incentive-based irrigation management, i.e., financial incentive to managers to save water.
Vietnam	• Establishment of Irrigation and Drainage Management Companies (IDMCs) Irrigation Enterprises (IEs) as autonomous, financially self-sufficient institution with commercial orientation. • Multifunctionality of the service Cooperatives: Cooperatives carryout a number of functions other than local-level water management, including extension and information dissemination, supply of inputs. • Pro-poor land tax system and irrigation service fee, i.e., discriminatory land tax and irrigation fee in favor of the poor where poor pay 50 percent less tax and fee than the nonpoor. • Irrigation service charges linked to service delivery (partial charges with partial irrigation service), irrigation charges are reduced during drought periods.
Indonesia	• Welfare-oriented people-based comprehensive irrigation management reform policy (focusing on five key areas - redefining and clarifying roles and responsibilities of irrigation management institutions, IMT, empowerment of WUAs, irrigation financing and charging and sustainability of irrigation systems). • Multiple-criteria-based irrigation charging, charge differentiation by geographic location and socioeconomic groups (poor and those in disadvantaged locations such as tail ends of the systems paying relatively less) in the transferred systems.
India	• Large-scale/state-wide implementation of reforms for PIM through “big-bang” approach • Increases in irrigation service charging after management transfer. • System of advance payments for irrigation charges in some states.
Pakistan	• *Warabandi* system of water rights and distribution at the tertiary level, i.e., rationing of scarce water supplies to farmers, including small and marginal farmers, equitably so that all farmers equally share short, adequate or abundant supplies, if the warabandi procedures are effectively implemented. • Recent changes in structure of irrigation charges from crop-based charging to flat-rate charging. • Emerging initiatives to integrating delivery of production inputs and related services (i.e., emerging agri-malls) to farmers. • Recent initiative to computerize land records to strength land records and land rights. • The organizational structure of irrigation management proposed under reforms, which is pro-equity and pro-poor as it proposes to involve farmers and their representatives not only from better locations and advantaged groups but also specifically from disadvantaged locations (tailends) and socioeconomic groups (small and marginal farmers) in the newly formed organizations, and pro-market (as it emphasizes on commercial orientation and financial autonomy of the new management institutions).

Country	Examples of good (or with good potential) conditions, institutions, management practices and initiatives.
Bangladesh	• Three specific pro-poor initiatives in large- and medium-scale canal irrigation systems: Labor Contracting Societies (LCS), Embankment Maintenance Group (EMG), Channel Maintenance Group (CMG). LCS, known as Landless Contracting Society aims at providing employment and income-generating opportunities to the rural people, both men and women, and ensuring fair wage and achieve high quality of construction work. At least 25 percent of the earthwork of any public water project/subproject/scheme is supposed to be reserved for the LCS. The majority of the members of both EMG and CMG are vulnerable women. In addition to earning from wage labor, women use the slopes of the canals and the embankments to harvest vegetables and thereby earn an extra income.

In sum, broadly speaking, our studies suggest that China and Southeast Asian countries have followed the strategy of "distribute first" and grow, which has been largely successful in reducing chronic poverty or have created favorable conditions for rapid poverty reduction. On the other hand, South Asian countries have adopted "grow first" strategy, largely ignoring the distribution issues, which have not only met with limited success in reducing poverty but also not led to favorable conditions for rapid poverty reduction. For China and Southeast Asia, the challenge is largely to sustain high rate of growth, while South Asia is faced with enormous challenges of improving both distribution and growth. In relation to the water-sector reforms, conditions for reforms are relatively favorable in China and, to some extent, in Southeast Asian countries, which are further strengthening and reforming institutions in response to increasing resource scarcity challenges in the sector. South Asia, on the other hand, is largely at the experimental stage in the development of new institutions. ***There are many lessons that South Asia can learn from Chinese and Southeast Asian experiences in water-sector reforms.***

The major issues and challenges in irrigation, and irrigated agriculture in general for each of the six countries can be summarized as follows:

- For China, while physical and economic productivity of agriculture is fairly high the key issues are to further increase water use efficiency, and develop and promote water saving and conservation measures, technologies and institutional innovations to address increasing water scarcity and competition across sectors.
- For Vietnam, overall decentralization and market reforms are leading to creating favorable conditions for rapid poverty alleviation; physical productivity in agriculture is fairly high, efforts are needed to enhance the value of agricultural productivity through enterprise diversification; and the key issue relates to further development, strengthening and integrating of management institutions at the national, provincial and local levels.
- Indonesia is somewhere in the middle on this spectrum where the current situation presents a mixed picture; physical productivity in agriculture is fairly high but economic value of productivity needs to be increased through crop and enterprise diversification and by strengthening farm to market linkages; and conditions are relatively favorable for promoting and implementing institutional reforms in the water sector.

- In India, current agricultural productivity level and its value is moderate, with significant potential to grow; and the key issue is to further expand institutional reforms geographically and in terms of organizational structure of reforms, further strengthen the newly created management institutions and develop strategies for sustainability of these institutions.
- In both Pakistan and Bangladesh, physical and economic productivity in agriculture remains much below the actual potential in a relative as well as in an absolute sense; institutional and management reforms are mostly at the beginning/experimental stages; conditions for reforms are relatively less conducive due to the existence of huge inequities in resource distribution and local power structures; key issues relate to correcting inequities, and creating favorable conditions for enhancing productivity and for effective implementation of reforms.

Future research and development efforts should be directed to the above issues in each of the six countries.

What Is Needed Now

Pro-Poor Intervention Strategies and Guidelines

In chapter 1 of this report, we have defined a pro-poor intervention in irrigated agriculture—policy, institutional, managerial, legal or regulatory, financial, economic, infrastructural or technological—as one which leads to improvements in: agricultural productivity; returns to factors of production such as land, water and labor; returns to farming; employment and wages; incomes and expenditures and overall livelihoods; and which generates assets and opportunities for the poor to participate in socioeconomic activities for their welfare, and have significant impacts on poverty reduction. Further, we suggested four aspects of any intervention based on its outcomes for the poor as: a) *Strongly pro-poor* intervention where the poor's share in positive incremental impacts/benefits of an intervention, such as improvements in the above indicators, is significantly greater than their current share and also greater than the share of nonpoor; *b) Pro-poor* interventions where the poor's share in positive incremental impacts/benefits of an intervention, such as improvements in the above indicators is greater than their current share; c) *Neutral* intervention where the poor's share in positive incremental impacts/benefits of an intervention, such as improvements in the above indicators, is equal to their current share; and d) *Antipoor* intervention where the poor's share in positive incremental impacts/benefits of an intervention, such as improvements in the above indicators is less than their current share or the poor's share in negative incremental impacts/dis-benefits of an intervention is greater than their current share. We will use these definitions to classify and identify whether a particular intervention would be strongly pro-poor, just pro-poor, neutral or antipoor.

It should be mentioned at the outset that there is no single magic solution that could solve all the poverty-related problems in irrigated agriculture. Efforts are needed on several fronts with innovative and effective approaches, and much more than the efforts made in the past or are being made at present times. Importantly, genuine motive and search for real solutions to the poverty problem require honest commitment, and in certain areas it requires hard tradeoffs and tough

policy choices. The poverty problem will not be solved only by changes in terminology to describe the poverty situation, and using more fashioned words and approaches to poverty such as livelihoods, pro-poor approaches, participation, partnerships, integrated approaches, good governance, community empowerment, capacity development and so forth, unless these are translated into real impact-oriented actions for creating their operational values. Before we proceed further, the following points should be noted:

a) In relation to the effectiveness of any intervention in terms of impacts on poverty alleviation, initial conditions and socioeconomic fundamentals do matter. Where initial conditions, whether they relate to equity in resource distribution or institutional arrangements (as discussed below) are favorable, one simple intervention can make a lot of difference. On the other hand, where such conditions are not so favorable, many interventions will make only little or no difference. Existence of a single basic condition that is not conducive to poverty alleviation can offset the poverty-reducing impacts of several good interventions, and correction of such conditions can result in multiplied impacts of a single intervention.

b) Some interventions can be implemented without any major changes in existing institutional arrangements, and with no or only little investments, others may require only moderate changes in institutions or small investments; some may need major changes in institutions or creation of new institutions or large investments; and yet others may need very tough choices to be made. Again, prioritization and sequencing of interventions are important.

c) Some interventions may not reduce poverty directly in the short run, but they are important for creating conditions favorable for enhancing impacts of other poverty-reducing interventions in the long term. Such interventions are often more important and may have even greater value for large-scale poverty reduction in the medium and the long run than those that appear to reduce poverty rapidly but only temporarily and only at a limited scale.

d) Real world resource constraints dictate that everything cannot be done at the same time, i.e., realistic prioritization of interventions, identification of appropriate entry points and sequencing of interventions are crucial.

e) Clear understanding on the part of policymakers and implementers of whether a particular intervention is pro-poor, neutral or antipoor or how an intervention could be made pro-poor is important.

Some of the interventions identified below are broad interventions that would increase the size of the pie with both direct and indirect positive impacts on poverty; and others are more targeted interventions that would help increase the poor's share in the pie through making growth process pro-poor and would thus have direct positive impacts on poverty. Further, most of the interventions identified are of "software" type with some of a "hardware" nature. These broad and targeted, and hard and soft interventions triggered together would achieve greater reduction in poverty than a single intervention, and the sum of the impacts of all interventions implemented

through a piecemeal approach will fall short of the aggregate dynamic impact achieved through a comprehensive approach.

The interventions identified and proposed here are based on ground realities, lessons learnt from cross-system and cross-country comparisons of diverse situations, and inputs from a wide range of stakeholders including farmers, NGOs, policymakers, and research and development professionals.

1. Getting the fundamentals right

Inequities in distribution of land, water, productivity, and education, and lack of opportunities for unskilled labor in agriculture are identified as the principal causes of poverty in South Asian irrigated agricultural systems. These factors tend to be interrelated, and tend to reinforce the impacts of each other. However, poverty-reduction strategies and agricultural and water-sector policies often tend to overlook the equity concerns, and where the existence of such inequities is recognized, concrete principles, approaches and strategies to reduce them are either absent or not implemented effectively. It is clear that high inequities in resource distribution hurt the poor, reduce growth in agricultural productivity and also cause delays in the much-needed reforms in the agriculture sector. Correcting existing inequities, particularly in resource distribution, is not only good for the poor but is something important for laying a solid foundation for strong rural economies. Without correcting the fundamental problem of inequities in resources distribution, policies addressing only peripheral issues will not be effective in achieving the objective of poverty reduction. The Chinese example of bringing equities in land distribution through effective land reforms in the early stages of development and its contribution to equity in benefits of investments in the irrigation sector and ultimately in reducing poverty offer very important lessons. In this regard, the study makes the following recommendations:

a. *Creating an enabling environment for poverty reduction:* The first and the basic step is to create an enabling environment for poverty reduction through development and strengthening of policies and strategies (specifically related to poverty reduction, land, agricultural and the water sector) and linking these policies under a consistent framework. If the commitment to poverty reduction is genuine, then the objective of poverty reduction must drive the process of related policy formulation and institutional development, not the other way round. Clear and concrete policy principles and strategies to reduce inequities should form the foundation of these policies. Further, strategic interventions to reduce poverty must be prioritized on the basis of their impacts on poverty reduction or their potential pro-poorness. However, policy development is one thing, but its effective implementation is another. Development of strategies for effective implementation of policies is obviously crucial, and the governments and donors have an important role to play in this area.

b. *Developing strategic approaches to poverty reduction:* Three major routes to rural poverty reduction as identified in this study are: i) land and agricultural-productivity-based growth and development through pro-poor interventions (*lands*); ii) labor-intensive nonfarm-sector-based growth and development through pro-poor interventions (*hands*); and iii) a combination of i and ii, *(i.e., both lands and hands)*. The first route emphasizes

land and agricultural-productivity-based approaches, the second is about development of the nonfarm sector, such as small-scale agro-industries, nonagricultural enterprises and emphasizes skill development and employment opportunities in the nonfarm sector. However, it is important to recognize that the development in the nonfarm sector generally depends, in many respects, on outputs from the farm sector. While the third approach would be important in the long run, the first approach remains key for creating conditions for the second approach to be effective. For South Asian systems, land and agricultural- productivity-based growth will be important for laying a solid foundation for poverty reduction.

c. *Promoting equity in resource distribution and creating permanent assets for the poor – which assets and how?* Lack of access to land and water and low or no skills/education for employment—three important assets for rural people—are identified in this study as major causes of poverty, especially in South Asian irrigated systems. The poorest of the poor are landless followed closely by the land-poor. While education/skill development is a key to improving human quality and reducing poverty, it generates outcomes over a longer period of time. In the short and medium term, improving rural poor's access to resources and assets such as land and water, and improving their quality where the poor already own such assets, would be a *strongly pro-poor* strategy and would create conditions for lifting people out of poverty permanently in South Asian systems.

Many related recent studies on equity, poverty and growth issues in developing countries also conclude that inequity in asset distribution impedes economic growth and development; that smaller-size family farms are more efficient, labor-intensive, productive and environmental-friendly than large farms in developing countries; and that land distribution to the poorest people has a strong positive relationship to poverty reduction.

Successful redistribution of lands to the poor through effective land reforms in Japan (in 1948, redistributing 41% of cultivated land to 81% of landless households), Taiwan (in 1953, redistributing 44% of cultivated land to almost 100% of landless households), South Korea (in 1948, redistributing 33% of cultivated land to 64% of landless households), (Prosterman and Mitchell 2002); China (between the 1950s to the late 1970s, especially in 1978 with the introduction of the "Household Responsibility System," which led to equitable distribution of land to all rural households based on family sizes), and Vietnam (in 1986 under the *doi moi* reforms, which led to equitable distribution of land to all rural households, based on family sizes) have contributed tremendously to lifting a large majority of the poor out of poverty, mostly permanently, in these countries. There is an ample documentation of the positive impacts of land redistribution on agricultural productivity, household food security, household incomes and rural stability. On the other hand, land redistribution attempts made through administrative reforms in India achieved only limited success; land reforms in Pakistan and Bangladesh largely failed to achieve desired results either due to poor records on landholdings or poor implementation of regulations. In light of such failures, the subject of land reforms in South Asia began to be considered a taboo. However, since late 1990s, there has been growing realization that poverty may not be effectively reduced unless permanent assets are created for the poor and the deprived. The IFAD 2001 report on poverty also concludes that without assuring adequate access to this most basic productive resource (such as land), the goals of eradicating poverty, reducing hunger

and promoting more broad-based and inclusive economic development will remain elusive at best. With increasing realization of the importance of equity in land distribution, and the role of access to land in chronic poverty alleviation, land reform issues are coming back on the mainstream development agenda, although there are strong controversies on approaches to land reforms. Based on the lessons learnt in this study, we present three options for promoting equity in resource distribution in South Asia and discuss the likelihood of their success, feasibility and cost implications.

Option 1: Making radical changes in the land distribution structure—ceiling-based regulatory/administrative land reforms for equitable distribution of land. However, given the historical conditions and factors, e.g., initial conditions in China and Vietnam were entirely different from those in South Asian countries; long-established rural-power structures, and in light of past experiences with such attempts in South Asian countries, fundamental redistributive reforms are unlikely to succeed. Accurate land records, which rarely exist in most situations, and effective implementation of the regulation, which is rarely the case in real-world situations in most South Asian countries, are essential for regulatory reforms. *While this broad-based regulatory approach remains an option, it may not be very realistic under the prevailing sociopolitical scenarios.*

Option 2: Promoting equity in land distribution and improving the poor's access to land through a combination of ceiling-based regulatory approach and incentive-based market approach, that is, buying lands from large landholders and distributing them to the poor landless and marginal farmers including poor women farmers, either on a grant basis or on subsidized rates or on long-term leases or through long-term loans to the poor. *This semi-targeted approach, though, appears an attractive option; however, some of the problems are similar to those as for option 1,and it may not be feasible due to huge costs involved.*

Option 3: Improving the chronic poor's access to land through an incentive-based market approach, with emphasis on providing a basic-size holding, to the chronic poor, that is economically viable and generate livelihoods sufficient enough to support an average family. For example, the threshold level in rural Pakistani Punjab is 2 hectares; of course, this threshold will vary by locality and country depending on a range of factors including quality of land, productivity, family size, access to nonfarm sources of incomes and so on, either on a grant basis or on subsidized rates or on long-term leases or through long-term loans to the poor. The targeted approach in this option would entail substantially less cost than, for example, for an approach as assumed in option 2, and this is something doable and should be done. *The emphasis should be on creating economically viable, managerially efficient, socially equitable and locationally consolidated landholding units. The newly initiated irrigation-sector reforms should be seen as an important entry point for the suggested land reforms.*

Land distribution to the landless poor will lead to increasing the share of the poor in direct and indirect benefits from past, present and future investments in irrigation to the poor. *Land and associated water distribution will be truly and strongly pro-poor interventions, and can be expected to create a significant dent in chronic poverty.* Government, donors and local-level NGOs can play a key role in such initiatives. The first step in this direction should be to distribute the remaining public lands to the chronic poor. For example, in Pakistan, about 0.29 million hectares of land resumed from large landowners by the government and 0.89 million hectares of state lands, though largely undeveloped, are still available for distribution. Some specific interventions and actions in this regard include the following:

- Develop a comprehensive database of land records/computerize land records, and identify landless/chronic poor where local-level NGOs can be involved in the identification process.
- Distribute public lands to the landless and chronic poor, providing them the basic-size of holding or a threshold level that generates basic livelihoods (e.g., 2 ha in Pakistan), and follow-up with facilitating the development of other infrastructure and improved access to technologies.
- Implement option 3 as suggested above.
- Simplify land-transaction procedures, and encourage development of land markets.
- Reduce land tax on basic-size of landholding (e.g., 2 ha in Pakistan).
- Strengthen tenancy laws with pro-poor orientation.

Three examples of such initiatives—failed case, partially successful case and successful case—offer us important lessons for effectively designing the proposed intervention:

Case 1: In Pakistan, as per official statistics, by 1999, the government has distributed 1.8 million hectares (or 8 percent of the cultivated area in the country) of lands including public lands and those resumed under past land reforms among 0.857 million beneficiaries. However, a significant part of such lands was of poor quality; further, there was no follow-up support to the new landowners in terms of access to irrigation and other infrastructure, technology, credit facilities and other support services. Therefore, there has been no visible improvement in the livelihoods of many poor farmers who received distributed lands.

Case 2: In Bangladesh, *Adarsha Gram, the ideal village project,* was initiated in 1988 as a part of the land reform program. The basic concept of this government-initiated targeted poverty alleviation program was to resettle the homeless and the landless on public lands *(khas*). In addition to homestead, the families were also to be allotted 1 acre to 1.5 acres of agricultural land (in the name of both husband and wife, each getting an equal share), with ownership inheritable but not transferable. By 1993-94, 33,121 families were settled against a target of 45,647 families in 845 *adarsha grams*. The project's mid-term and final evaluations indicate that while the establishment of villages on public lands was a significant achievement, a large number of beneficiaries have been provided with only tiny plots of land with shelter, and agricultural lands allocated to beneficiaries in most cases were unsuitable for cultivation and often located in areas where access was difficult (Hye 1996).

Case 3: Sri Lanka has implemented a land resettlement policy over the years directly targeting the landless and the poorest of the poor in an attempt to enhance food security and eradicate poverty. Significant investments have been made in establishing irrigated land settlement schemes in the dry zone of the country to resettle poor landless families from the overcrowded wet zone and provide them with an opportunity to enhance their livelihoods. By 1998, some 328,000 hectares of land had been developed under irrigated settlements and about 200,000 poor families had been resettled. One such scheme, an example of a large irrigation system that was developed targeting the poor, is located in the Walawe *ganga* (river) basin in the south of Sri Lanka. Presently, about 17,400 hectares of irrigated land provide direct and indirect support to 34,000 families in the system including landless and encroachers. A large number of these families have been relocated from other nearby districts for settlement in the area. Each settler household is given a parcel of 1-2 hectares for cultivation of paddy and other field crops, in addition to land allotment for homesteads. A multipronged strategy was adopted, with the distribution of public lands, along with the development of irrigation and other physical and social infrastructural and support services. The recent poverty assessments suggests that access to land and water has made significant differences in the lives of the poor, with a large majority of families graduated out of chronic poverty. All indicators of human poverty, such as the dependency ratio, mortality rate of children below 5 years, housing, education and other facilities, clearly demonstrate that households in these schemes with access to land and irrigation water are socioeconomically much better-off than those in nearby areas with no access to these resources.

Based on the lessons learnt from these cases and on a review of literature on these issues, it is suggested that the proposed initiative for land distribution (under option 3 above) to the chronic poor would be effective, only if they are seen as important vehicles for graduating people out of poverty, and the following preconditions are met:

- Land distribution and the poor's access to land do not lead to heavy debt burdens on the poor households.
- Landholdings are of reasonable size to support a family and land is of good quality and productive.
- Land distributed to the poor is free from disputes.
- The new owners are given the right to hold title to land with regulation on the possible resale of land.
- Land distribution is accompanied with a packages of support services (such as credit, technology, information and market links).

In addition to creating assets for the *chronic poor* as suggested above, efforts are also needed to reduce temporary poverty and vulnerability of those who are only "*sometimes poor" or transient poor* (who constitute a significantly large part of the poor population in irrigated agriculture and who often need little assistance to move out of poverty). Improving their access to credit, and promoting risk-management approaches, such as agricultural-enterprise diversification would be an important strategy for reducing vulnerability and temporary poverty.

d. *Enhancing benefits of existing assets to the poor smallholders*: Two important aspects are:

i) While equity in land distribution is good for poverty alleviation (as suggested above) *avoid* what may be called over-equity in land distribution, as for example, the highly equitable land distribution policy of "good with bad and near with far" in China and Vietnam, which lead to excessive scattering of already small land units owned by households resulting in inefficiencies in farm management. Therefore, avoid distribution policies that lead to excessive fragmentation of landholdings, and develop effective strategies for consolidation of fragmented land parcels into economically viable units.

ii) Give priority to smallholder farms for land-quality improvements. Simple measures are often more effective. Raising awareness on land-quality issues and on cost-effective measures to address problems, such as salinity and waterlogging, through improved irrigation practices, land use patterns and on chemical and biological measures [including pre-sowing irrigation for leaching salts, increasing frequency of irrigations, conjunctive use of surface water and groundwater, precision irrigation, planting of salt-tolerant crops, rotations in crop cultivation, land leveling, use of gypsum and green manures, testing of land and water quality on a regular basis] through media and by involvement of local NGOs. Newly created organizations, such as local water user groups/associations can also be used as vehicles for dissemination of these technologies and measures.

2. Developing Separate Models for Poverty Alleviation

In the past, poverty alleviation initiatives have often tended to approach the problem by taking one model fit for all situations, ignoring many specifics of poverty. The study clearly brings out that the poverty problem differs in nature, magnitude and intensity across geographic locations within and outside irrigation systems, hydrological zones and across various socioeconomic groups (chronic poor vs. temporary poor; landless and land poor vs. landholders; nonfarmers vs. farmers) and across locations (rain-fed and marginal areas vs. irrigated areas; downstream vs. upstream areas; groundwater-poor vs. groundwater-rich areas; water short vs. water adequate/abundant areas; areas with no or little diversification vs. areas with greater diversification, such as paddy and non-paddy growing areas) suggesting that separate models tailored to specific situations would be more effective for poverty alleviation. The former groups and locations generally need long-term interventions through the development of resources/infrastructure to improve the average incomes while the later groups/areas need interventions that help maintain already higher-average incomes. Also, the former groups and areas call for relatively greater investments than the latter; but the impacts on poverty alleviation of such investments will be much more in these areas/groups than those in other areas. For the former groups/areas, the public sector should play a key role at least in the initial stages, while for the latter groups/areas, the private-sector role including that of NGOs should be promoted.

Suggested separate poverty-alleviation models include the following:

"Permanent" poor (chronic poor) and "sometimes" or "temporarily" poor (or transient poor) The permanent poor group, which often consists of resourceless or resource poor—land and water, needs a big push through asset creation as discussed above. "Sometimes" poor or vulnerable groups often need only little help to move out of poverty; improving their access to credit, promoting farm-enterprise diversification and creating seasonal employment opportunities for them (among others, involving them in seasonal O&M works, water distribution, fee collection and other similar activities as, for example, by establishing landless contracting groups or channel maintenance groups established in Bangladesh).

"Irrigated areas," "marginal areas" and "rain-fed areas": Permanent or chronic poverty is much higher in rain-fed areas, followed by semi-irrigated or marginal areas, because of overall low average incomes and expenditures; on the other hand "temporary" poverty is much higher in irrigated areas where, while average incomes are generally higher, fluctuations in incomes are also high because of agricultural seasonality and income fluctuations. Rain-fed and marginal areas require long-term interventions that improve average incomes of the poor, while irrigated areas need interventions that help sustain relatively higher incomes, and measures to overcome fluctuations in incomes. The former areas need development of irrigation infrastructure and investments in development of resource-conserving and land-improving technologies with a focus on small-scale agriculture, while the latter areas need targeted rehabilitation of existing infrastructure for maintaining the stream of benefits including targeted lining of canals, particularly in areas of poor groundwater quality, technology dissemination and adoption, and measures to address temporary falls in incomes and expenditures, such as farm enterprise diversification and micro credit.

Upstream and downstream areas: As elaborated earlier, permanent poverty is higher in downstream areas than in middle/upstream areas. The former areas need interventions that help smooth and maintain incomes during a year while latter areas need interventions that help increase average incomes.

"Good-quality groundwater" areas and "poor-quality groundwater areas": Poverty is generally more and deeper in areas where groundwater is either not available or is of poor quality. Separate strategies are needed for poverty alleviation for each of these areas under the integrated management framework as further elaborated under point 4 below.

3. Integrating delivery of inputs, technologies, information and other services for productivity improvements in agriculture through public-private-sector partnerships: As elaborated earlier, one of the principal causes of low productivity in South Asian systems is lack of timely access to adequate good-quality inputs (such as seeds, chemical fertilizers, micro-finance, etc.), productivity-enhancing and resource-conserving technologies and better practices, information, and other related services including output markets; this is also due largely to high transaction costs not only in the delivery of such services but also in accessing these services by farmers. This is largely because institutional mechanisms that can help provide access to these factors and services either do not exist or they are fragmentary, of poor quality, limited in capacity, and often inefficient, exploitative and antipoor. What is needed is to develop and

strengthen institutions that ensure delivery of these services at wider scale, provide services in an integrated manner to reduce transaction costs, ensure that transaction costs of monitoring and quality control are low, and also ensure that there are strong incentives to service providers. The delivery and access to these services by farmers can be improved by integrating them into a package and involving the private sector in the delivery of the package through one-stop shops/one-window operation as discussed earlier in section c and further elaborated with the proposed framework (in Hussain and Perera 2004).The concept of integrated service provision as suggested here should not be confused with the concept of public-sector administered integrated rural-development approach adopted in the past, which resulted in only limited success, and it should also not to be misinterpreted in terms of creating large monopolies.

4. Innovating irrigation management with pro-market and pro-poor orientation—how? Four priority areas are identified here, which are linked and reinforce the effectiveness of each other. They are:

a. Moving forward irrigation-sector institutional reforms with pro-poor orientation: The principal causes of low irrigation efficiency and overall irrigation performance, as discussed in the previous sections, are weak management institutions and inadequate funding. The IMT and PIM approach leads to improved performance and the poor also benefit from these initiatives. In the on-going reforms, priority should be given to creating conditions for reforms, particularly in Pakistan and Bangladesh, replicating and up-scaling recent reform initiatives, expanding the coverage of newly created tertiary-level organizations/water user groups in terms of their functions, water allocation, in addition to physical infrastructure maintenance works, and strengthening or establishing of the second and third tiers, which either do not exist or weak in most cases, of the three-tier reform model; and, importantly, developing strategies for sustainability of organizations as discussed below. Sequencing of reform activities is key (e.g. ➔ develop clear policies, develop management organizations, rehabilitate/improve infrastructure, establish accountability procedures and a regulatory framework, set performance standards, handover, increase irrigation charges, link service delivery to irrigation charges, set targets and monitor progress).

b. Towards multi-functionality of water user groups for long-term sustainability: As explained earlier, newly created water user groups/organization are single functional, i.e., irrigation management. In the initial phase of reforms, these organizations may be functional due to financial incentives given to them in the form of grant funds from donors for carrying out necessary activities. However, in the long run, their continued functioning and sustainability and members' participation will depend on the type of incentives the mangers and members receive. The likelihood of sustainability of these organizations and their success may be enhanced if they are made *multi-functional with some commercial orientation (*e.g., like emerging farmer companies in Sri Lanka where they carryout irrigation management activities and other income-generating activities), *and using them as vehicles for delivery of services to farmers*. This also means that irrigation-sector institutions need to integrate and link their central task of irrigation management and service delivery to agricultural productivity and poverty alleviation. However, more fieldwork and action research are needed on understanding potential

multifunctionality of water user groups, to explore how these groups in our study countries could be made *multifunctional*, and what their implications for the poor would be?

c. ***Reorienting irrigation service delivery with commercial principles and incentives, with enhanced accountability and regulatory backup.*** Lack of commercial orientation, weak or no incentives in management, absence of accountability and effective regulatory backup are the fundamental causes of poor service delivery in the irrigation sector. Improvements in these four areas should form the core of new institutional arrangements in the sector as discussed above. Specific measures include linking service delivery to irrigation charge/payment; only those who pay fully get full service, those who pay partially get only partial service; offering monetary incentives to managers/service providers, and establishing and implementing accountability procedures and linkages as discussed below.

d. ***Making irrigation-sector financially self-sufficient***: Continuing financial dependence of the irrigation sector on public-sector budgetary allocation, which is often inadequate, is one of the major causes of poor system performance and poor service delivery. This, in turn, is the outcome of low revenue from poor collection of low irrigation charges which, particularly in South Asian systems, are neither linked to service delivery and O&M costs, nor reflect the value of water [for example, average canal water charge in Pakistani Punjab is Rs 420/ha/year (US$7/ha/yaer), which constitutes 2.5 percent of the gross value of product/ha, compared to groundwater bought from the private water market which is nine times more expensive than the canal water (implying that the value of irrigation water/marginal returns from irrigation are nine times the canal irrigation charge)]. The outcome is that irrigation system performance continues to remain poor. Such a situation creates disincentives not only for managers but also for water users. As argued in the previous sections, low irrigation charges applied uniformly to all socioeconomic groups of water users significantly disadvantage the poor who suffer the most from poor performance and service delivery. A financially self-sufficient irrigation system is good for service delivery and also good for the poor. Specific actions in this area include the following:

i) Correct charging structures, and link charges to service delivery.

ii) Increase charges to the level that at least covers reasonable O&M costs, and gradually move away from the irrigation water-tax concept (Bangladesh), which has the connotation of irrigation water being a pure public good; towards irrigation water fee (Pakistan and India), which has the connotation of irrigation water being a semi-public good; towards more differentiated irrigation water fee (Vietnam), which has the connotation of irrigation water being a semi-private good; towards irrigation water pricing (China), which has the connotation of irrigation water as a sort of private good.

iii) Introduce and promote a system of advance payments and move away from the “first come first served approach” to the “first pay and first served” approach for

service- delivery charges to strengthen accountability linkages between service providers and users, and to improve on the collection efficiency and overall cost recovery, leading to financial self-sufficiency of the sector.

e. ***Setting performance standards and poverty-alleviation targets in irrigation systems***: Irrigation-system performance and service delivery must be guided by performance standards and poverty-alleviation targets, and not the other way round. Irrigation managers and/or organizations should be required to meet certain standards in terms of infrastructure maintenance, financial self-sufficiency, equity in water allocation and distribution, water use efficiency and productivity, environmental sustainability and poverty alleviation by setting clear and realistic standards through regular performance assessments and monitoring. While effective regulations may be necessary, providing financial incentives to managers/management organizations will be important for effective implementation of this approach.

f. ***Reorienting water rights and allocations with pro-market, pro-equity and pro-poor approaches***: This relates to ***b, c*** and ***d*** above. It is now becoming increasingly clear that:

a) The poor mostly rely on, and prefer to buy/pay for, goods and services in markets rather than depend on non-market based allocation of goods and services, which often never reach them and deprive them of such services. Poor smallholders' greater participation and reliance on private groundwater markets (where they buy water that is nine times expensive than canal water) offers important lessons in this regard. In general, market-based allocations actually benefit the poor smallholders.

b) Greater equity in water allocation and rights increases productivity and efficiency of water use, and both are good for the poor; contrary to conventional wisdom the study did not find any trade-off between equity and efficiency/productivity in the systems studied. A detailed analysis for Pakistani systems clearly suggests that equity-based and pro-poor water allocations lead to increased overall productivity and growth in agriculture.

c) A combination of tools from pro-market, pro-equity and pro-poor approaches generates positive outcomes that cannot be achieved with only one of these three approaches.

The study suggests that water rights and allocations at all levels - primary, secondary and tertiary levels - should be based on and reflect the following:

- Cost of supplying canal water (and, in the long run, value of water to the society).
- Equity in water allocation across socioeconomic groups (small vs. large farmers) and upstream and downstream areas in canal systems.
- Priority in canal-water allocations to disadvantaged areas and communities in irrigation systems, especially in areas where communities depend on agriculture for their livelihoods and other sources of water (groundwater), are limited or absent by specifying and effectively enforcing water rights.

The strategies and interventions as discussed in *a, b, c, d* and *e* will help achieve *f*. Further, involvement of the poor and their greater representation in water management and allocation, e.g., greater representation from poor small farmers, and those from disadvantaged locations, such as tail ends, will be an important strategy for improved water allocation to the disadvantaged areas.

g. ***Enhancing benefits of past and new investments in irrigation to the poor:*** The study clearly brings out that the poor in South Asia have only partially benefited from canal irrigation investments due to a variety of constraints, as discussed earlier. Canal irrigation should be, and can be, made strongly pro-poor and the overall benefits of irrigation to the society can be enhanced by adopting the following approaches:

i. ***Integrating management of surface water and groundwater, with separate strategies for different areas*****:** Poverty is found to be relatively high in areas where access to canal water is less, and groundwater is either not available or not developed or completely unfit for cultivation or is of marginal quality. Separate strategies are needed for each of these situations, some call for development of groundwater, others call for canal water reallocations and yet others call for conjunctive use of surface water and groundwater. Canal water management, planning and allocation should account for availability and access to groundwater in order to enhance antipoverty impacts of canal irrigation, and that is possible only when these two sources of water are jointly managed. Specific actions in this regard include the following:

- Develop groundwater zones based on its availability and quality.
- Develop strategies for canal-water-reallocation to areas/communities where access to good quality groundwater is less or groundwater is only marginally fit but still useable for irrigation.
- Promote conjunctive use of surface water and groundwater.
- Provide targeted subsidies for the poor areas and communities where groundwater can be developed.

j. ***Enhancing the value of water to the poor - crop and enterprise diversification, and resource-conserving technologies*****:** Value of irrigation water can be enhanced through diversification of cropping patterns towards less water-consuming high-value crops (e.g., high-value cash crops, horticultural crops) and other high-value agricultural enterprises (e.g., livestock, poultry, fisheries) and the use of cultivation and resource-conserving technologies (e.g., bed and furrow method, zero tillage technology, precision irrigation, precision land leveling, and land-quality improvement measures), and through improved access to key production inputs, practices and services including agricultural extension and market-related information. It is important to note that crop and farm-enterprise diversification requires much more labor (the principal asset of the poorest of the poor) than specialized farming; therefore, promoting crop diversification will not only lead to enhancing the value of water but also resulting in greater employment opportunities for the poor with pro-poor outcomes. The key issue in relation to technologies and services is not so much of their availability but of their effective dissemination and delivery to farmers. Development of effective mechanisms and institutional arrangements that lead

to widening of access by farmers to these services, and that entail low transaction costs not only in delivery but in access to these services by farmers, should be an important strategy for enhancing the value of irrigation water to the poor. Delivery of these services in an integrated manner with public-private-sector partnerships, and potential use of WUAs as vehicles for service delivery are important options that need to be further explored.

6. ***Developing capacity and real empowerment (C&E):*** Capacity development and empowerment do not mean just organizing lectures, training programs or workshops for those already trained and well connected or for those already empowered. C&E efforts should focus on creating mass awareness on issues and problems, solutions and best practices at the local level for communities and households through the involvement of media and other effective means of information; it involves the creation of conditions conducive to change, development of new skills, creation of opportunities for them to use the new skills, and creation of livelihood opportunities for the poor. Efforts should focus on regular updating of policymakers, creating new water leaders, empowering of existing local-level leaders, managers and farmer's representatives. Some of the simple, but effective, actions include disseminating policy briefs on water and poverty to policymakers; briefing of media personnel; disseminating best pro-poor practices at the local level in local languages through the media; initiating programs such as organizing information-dissemination days/farmers-days in poor communities; and introducing and promoting curricula on water and poverty in colleges and universities.

Developing and strengthening the knowledge base on water, productivity and poverty: Research and development on water-related poverty issues in irrigated agriculture should form the key part of the efforts to address these problems. Identification, analyses and promotion of pro-market, pro-equity and pro-poor approaches, interventions, and better practices should take priority on the knowledge-development and -dissemination agenda.

This study identifies major issues and priority areas for further research and development for each of the six countries:

China: Develop and promote water-saving and -conservation measures, technologies and institutional innovations for increasing water use efficiency to address the problem of increasing water scarcity and competition across sectors.

Vietnam: Develop and promote measures to enhance the value of agricultural productivity through agricultural enterprise diversification; and develop approaches to further developing, strengthening and integrating management institutions at various levels.

Indonesia: Develop and promote approaches to enhancing the economic value of agricultural productivity through crop and enterprise diversification and by strengthening farm to market linkages.

India: Develop and promote approaches to enhance both physical and economic productivity, and develop strategies for expanding reforms and strengthening the newly created FOs for their long-term sustainability.

Bangladesh and Pakistan: Develop strategies to correct prevailing inequities in resource distribution and opportunities, and to create conducive conditions for enhancing both physical and economic productivity in agriculture and for effective implementation of institutional reforms in the irrigation sector.

Further, efforts should also be put to effective dissemination and use of knowledge, through involvement of key stakeholders at global, regional, national and community levels. Some key questions in this regard are: *What proportion of knowledge generated by the Consultative Group on International Agricultural Research (CGIAR) centers and other related organizations over the past 20 years has been relevant, and what proportion of the relevant knowledge has been effectively disseminated or is accessible for operational use or is being used by donors, national governments and policymakers, local-level mangers and farmers, are important questions that need not only attention but also effective strategies to address the related issues.* Institutionalizing the development of operational packages of knowledge and technologies, and establishing effective dissemination mechanisms for timely delivery of such packages at various levels should be an important strategy. International donors can play an important role in facilitating such initiatives.

Other Important Considerations

1. Poverty alleviation efforts that are based on initiatives coming from governments themselves are more likely to succeed and be effective than those that are simply the outcomes of pressures from agreements with donors that often require meeting certain targets in a specific time periods and often ignoring the pre-requisite or necessary conditions required for certain initiatives, although sometime pressures and interventions from donors are helpful (particularly in areas where the country governments fail to make hard decisions). Interventions that are based on unrealistic targets and strict deadlines attached to them, ignoring the appropriate process to be followed end up being successful more on the paper than on the ground. Also, importantly, in poverty alleviation efforts, the very objective of poverty alleviation must drive the process of policy formulation and institutional development, and not the other way round.

2. Where socioeconomic fundamentals and basic conditions are favorable, small intervention will have significant impacts in reducing poverty; on the other hand, where basics are missing and necessary conditions are not in place, many interventions for direct poverty alleviation may result in only limited success. For example, under conditions of high inequities in land distribution, large investments in irrigation may not have significant direct positive impacts for the land-poor and vice versa. Getting the basics right and creating conditions conducive for large-scale poverty reduction must be

given priority over any intervention that appears to reduce poverty directly in the short term but at a limited scale.

3. Continuing improvements in policies, strategies and institutional arrangement for poverty alleviation are always good, but too undue and frequent changes are bad. Often, when a political leadership in a developing country changes, past policies and strategies, including those with good potential, also change and in many cases such undue changes are the main causes of failure of even those interventions that have good potential for poverty alleviation. Developing and promoting strategies that enhance long-term continuity of potentially effective poverty-alleviation policy interventions should be an important step in this direction. Equally important is to ensure consistency in related policies, i.e., water-sector policies, agricultural development policies, rural development and poverty alleviation policies/strategies; for example, it may be that water-sector policies attempt to discourage high water-consuming crops, while incentives given through agricultural policies end up promoting such crops.

4. It is important to move away from *ad hoc* and temporary approaches to poverty alleviation towards more solid solutions that help lay strong foundations and that help create conditions for lifting the poor out of poverty permanently, for example, create permanent assets for the chronic poor rather than help them with temporary relief grants except, of course, in emergency-like situations, which call for such relief measures. Such peripheral and temporary solutions are not only more costly but often have no long-lasting impacts. Let us not construct a road in a way that requires repeated rebuilding.

5. As elaborated in the background part of the study, there are many dimensions of poverty, both material and nonmaterial dimensions. While the nonmaterial aspects of poverty are important, they are largely the result of inequities in, and lack of access to, resources and income opportunities, two fundamental causes of most of the poverty- related problems, such as problems related to health, education, large family size, dependency, food insecurity, etc., as there is a close correlation between resources and incomes with other indicators of human well-being. Therefore, poverty alleviation efforts should focus on improving equities in, and access to, resources and income opportunities (that is, take care of these two problems, and rest will be taken care of by them.

6. On institutional reforms, specifically in relation to participatory management and system handover, questions often arise as to whether the reform implementation should be a slow and gradual process or a quick “big bang” approach; whether the reform approach should be top-down or bottom-up; and in the hierarchy of canal systems, management levels (tertiary, secondary and primary) which level should be managed by FOs/service providers and at which level the public-sector agencies should play a greater role. The outcomes of experiences on these issues are mixed, and the questions remain highly controversial.

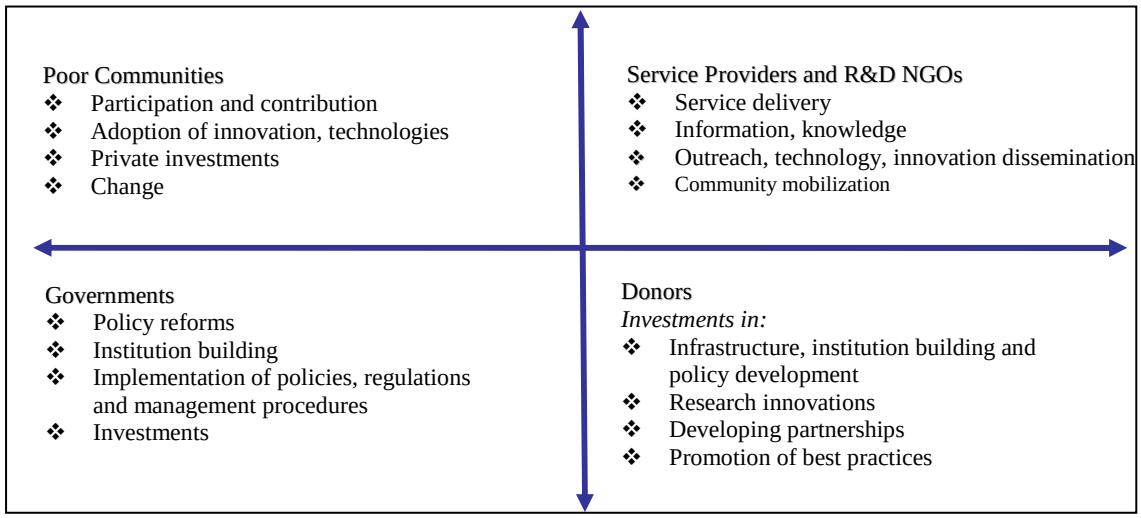
The experience with reform so far suggests that where the reform implementation is based on unrealistic targets and strict deadlines attached to them, ignoring the appropriate process to be followed often end up being successful more on the paper than on the ground, e.g., formation of

water user groups in Bangladesh; on the other hand, where the reform process is very slow, it often leads to incomplete implementation of the reform model not only geographically but also in terms of organizational structure, and it remains an unfinished agenda for quite sometime (and may actually adversely affect the sector than benefit it), e.g., reform implementation in Pakistan. As Johnson et al. (2002) note that "some of the most dramatic successes have come from programs that expanded coverage to the entire state or country rapidly; (through a quick "big bang" approach) ….and instituting a reform program with a few pilot interventions is usually either an excuse to avoid serious institutional reform or one to delay it with an expectation that the government will change and the policy will change as well."

However, based on our experiences in this study, it is suggested that reform should not be too slow to not lose the whole spirit and the purpose on the way; also it should not be too fast in the sense that it does not go through the essential process for the long-term success of the initiatives. It is important to have targets and a time frame but, of course, they should be more realistic considering that reform by nature is a slow process. While too much piloting slows down the whole process, piloting of reform interventions at the initial stages through action research is important. The approach should be to experiment with the models at the local level; if the experiment works then it should become a model for careful replication and up-scaling (In China, the use of models and local-level experiments in specific provinces, prefectures, countries and even farms have been the favored approach). On top-down vs. bottom-up approaches, the initiation and implementation of reforms need clear vision and firm commitment from the top leadership, both political and policymaking, to succeed. While bottom-up initiatives, and support from below are important, initiatives from the top are generally key to move the reform agenda forward faster. The question of which level should be managed by whom depends on the size and the complexity of the systems, and the cost of information collection. Generally, the larger-size systems are more complex than smaller systems, and within larger systems, complexity increases at the higher levels, which require specialized professional skills for operations and management. Water user groups and private local-level organizations are best suited to manage tertiary and secondary levels due to much less complexities at the these levels and also due to their comparative advantage in having local-level information. On the other hand, public/semi-public agencies may be required to carryout planning and more complex works at the primary level.

Last but not least, for all the above to happen, building effective partnerships among service providers, governments, communities, research and development organizations and donors are important. Each one of these partners has its own comparative advantage. Figure 4.1 highlights some of the key areas where each partner can make contributions, with the objective of improving irrigated agriculture for immediate enhanced antipoverty impacts of irrigation.

Figure 4.1: Partnerships, the way forward.



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