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Water Policy Briefing

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Putting research knowledge into action



Pro-poor Intervention Strategies in Irrigated Agriculture: Lessons from the Asian Experience

Measuring discharge from a diesel pump in West Bengal, India

PHOTO CREDIT: Aditi Mukherji

Irrigated agriculture has contributed greatly to food security in Asia—and irrigation projects present new opportunities for reducing poverty. This requires that projects deliberately tilt towards the poor. Moreover, policymakers, implementers and managers need to adopt an integrated approach when using irrigation as a pro-poor intervention strategy. With the right institutional and technical conditions, an effective incentives structure and proper implementation and management practices, pro-poor irrigation projects can make a significant difference to poverty in the region.

Pro-poor Intervention Strategies in Irrigated Agriculture: Lessons from the Asian Experience

How sensitive is poverty to irrigation projects in Asia?

Asian agricultural economies have experienced significant upswings in productivity since the Green Revolution in the 1960s. As widely acknowledged, the Green Revolution was made possible through coordinated infusions of vital inputs into the agricultural systems of the region. Irrigation through major and medium canal systems was one of the most crucial inputs to the Green Revolution¹. Three decades down the line, the Asian economies benefiting from the Revolution have made famines history. However, after the euphoria over this significant achievement subsided, a major gap was identified—irrigation projects have failed to make the desired difference in the lives of its poor, subsistence and marginal farmers.

In 2001, IWMI started a collaborative research study with several national partners to evaluate the performance and prospects of selected major and medium canal irrigation projects in Bangladesh, China, India, Indonesia, Pakistan and Vietnam in terms of their impact on poverty. This study compared and analyzed both the policy matrices and systemic components of the sample projects with a particular focus on their poverty alleviation roles. The synthesis report pools cross-country lessons and makes policy recommendations towards making irrigation projects more sensitive to poverty. This water policy briefing summarizes the major findings and recommendations of the study.

Making irrigation ‘pro-poor’

In light of their declining poverty alleviation role, Asian irrigation projects need to be re-appraised. ‘Pro-poor’ interventions are required to ensure that the poor have an equitable share in benefits. An intervention may be declared to be ‘pro-poor’ when they are characterized by any or all of the following criteria:

- When benefits to the poor are more immediate and greater than those to the non-poor.
- When policies, institutions, programmes and interventions are focused towards creating a positive bias towards the poor—allowing them to gain a progressively higher share in the benefits and enabling them to participate more productively in economic activities.
- When they enable the poor to get higher or optimum returns from their assets and resources through targeted investments in their socio-economic domain.

Benefits and costs of irrigation

Irrigation affects various facets of socio-economic and other systems in which it is embedded. The nature of the impact on each system varies and comprises a complex web of benefits and costs. Based on the country studies, the impact of irrigation systems has been categorized into five generic typologies as shown in Table 1.

Table 1: Typology of irrigation benefits and costs²

Type	Benefits	Costs
Type 1	Direct benefit from employment generation	Direct cost of displacement of the poor households and potential for land encroachment
Type 2	Direct benefit from increase in crop productivity	Direct cost of land degradation through salinity and over-use of chemical fertilizers
Type 3	Localized indirect benefits from productivity induced employment, wages, income and consumption	Localized indirect cost of unemployment through land degradation, mechanization and other labour saving technologies
Type 4	Other localized benefits from multiple usage of water, groundwater recharge and private investment in irrigated agriculture	Other localized costs of public health risks, loss of biodiversity and water pollution
Type 5	Broader level multiplier benefits from linkages with non-agricultural sectors	Broader level costs of abstraction of river waters leading to degeneration of river health and consequent impact on livelihoods of poor communities dependent upon river health.

¹ In conjunction with the introduction of High Yielding Varieties (HYV) of seeds. Others were chemical fertilizers, credit and extension services.

² Costs related to Types 3, 4 and 5 could also be due to causes other than irrigation. For example, agricultural intensification can have an impact on wage levels and labour (Type 3). Similarly, the effects of Types 4 and 5 could be attributed the entire water development project, in addition to irrigation infrastructure.

This Water Policy Briefing is based on **Poverty in Irrigated Agriculture: Issues, Lessons, Options and Guidelines—Bangladesh, China, India, Indonesia, Pakistan and Vietnam**. Final Synthesis Report by Intizar Hussain, IWMI and ADB 2005.

Irrigation and poverty

The result of the cross country research is a confirmation that irrigation does reduce poverty. In general terms, in the countries under study, the average incidence of poverty in irrigated areas is about half that of non-irrigated areas. There are three routes through which irrigation affects poverty:

1. Micro-pathway: increasing returns to the physical, human and social capital of the poor.
2. Meso-pathway: integrating the poor with factor, product and information markets.
3. Macro-pathway: improving national growth rates and creating second generation positive externalities.

However, two important qualifiers remain. Firstly, though poverty incidence is reduced through irrigation, it is not obliterated. The average level of poverty incidence in the sample irrigation systems is still 34 percent. Further, significant inter-country, inter-region, inter-system and even intra-system differences are observed in poverty incidence. Table 2 gives a few snapshots of these differences.

Secondly, certain factors affect the poverty mitigation impacts of irrigation systems. These straddle the social, political, economic and environmental matrices of these systems.

Distribution of land and water

Wherever land is distributed equitably, irrigation water too is distributed equitably. Chinese and Vietnamese systems score over South Asian systems in this regard. The Gini coefficient of land distribution in the study countries are as shown in Table 3.

Landlessness is not a major problem in China and Vietnam. In China, the poorest farmers who rely more on farming have the greatest access to water when measured in terms of per capita or per household irrigation water use. Further, there is an inverse relationship between size of land holding and intensity of cropping. Pro-poor policies in water distribution for small holdings would automatically promote water use efficiency. This is further validated by an analysis of the poverty elasticity of crop productivity in the systems. In China and Vietnam, a one percent rise in productivity reduces poverty by 4.42 percent and 0.91 percent

respectively. The figures vary between 0.15 percent and 0.28 percent for South Asia.

Scale and type of irrigation system

Disparity in poverty figures between the head and tail reaches of large canal irrigation systems is more pronounced than in small systems. However, good quality groundwater is more effective as an irrigation source for reducing poverty than canal water, owing to the former's advantages of higher reliability and control. The impact on poverty is greatest in systems where canals complement groundwater, provide recharge benefits and encourage private investments in factors of production.

Gender, minorities and underprivileged groups

It is well known that women and disadvantaged groups bear the major brunt of poverty than others. Obviously, projects that have directly addressed the special requirements of these groups have better poverty impacts than other projects. In this respect, the following interventions, which are actually observed in few of the sample countries, can be noted:

- **Positive gender and class/caste bias in employment generation activities:** In Bangladesh, labour contracting societies, embankment maintenance groups and channel maintenance groups provide gainful employment to the poor with priority given to women and women-headed households. In addition to earning wages, women also use canal embankments for cultivating vegetables—thus further strengthening their livelihood systems.

Table 3: Distribution of land ownership

Country	Gini coefficient
China	0.19
Vietnam	0.25
Pakistan	0.51
India	0.53
Indonesia	0.57
Bangladesh	0.70

Note: "Lower the coefficient, higher the equality.

Table 2: Illustration of types of differences in incidence of poverty

Inter-country difference	Observed incidences of poverty in the sample systems are as follows: China (7%), Vietnam (15%), India (40%), Indonesia (41%), Bangladesh (47%) and Pakistan (52%).
Inter-regional difference	Southeast Asian and Chinese systems show less poverty incidence than South Asian systems.
Inter-system difference	Net productivity benefits (difference in net output values between irrigated and non-irrigated areas) ranges from less than \$50/hectare/year in Hakra-4 (Pakistan) to over \$600/hectare/year in LID-HP (Henan, China).
Intra-system difference	Significant differences exist in poverty incidence among the upper, middle and tail reaches of irrigation systems. Again, this differs across countries. The largest disparities are observed in India, while Chinese systems are more uniform.

- **Mobilization of women by women:** Women's participation in irrigation institutions should be strengthened through persuasive efforts of women themselves. For example, when representatives of NGOs or progressive women from the villages disseminate messages, it has a greater impact on women's involvement.
- **Incorporating gender sensitive roles in project objectives:** When irrigation projects are designed to be amenable to multiple usage of water (such as household use, washing clothes, feeding and washing animals etc.), their gender-based poverty impact is bolstered. This kind of intervention has been observed in the Udawalawe Scheme of Sri Lanka.

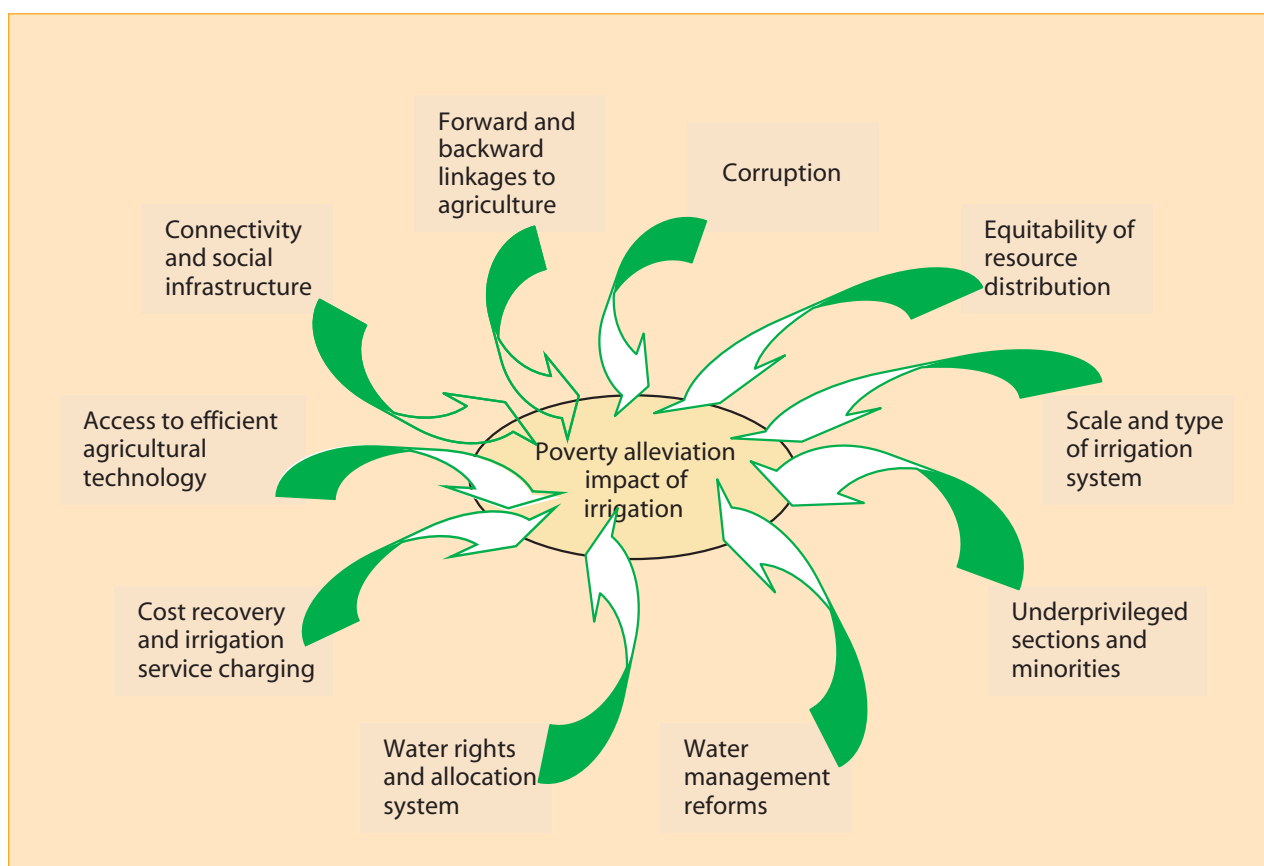
Management of Irrigation Systems

Reforms involving Irrigation Management Transfer (IMT) and Participatory Irrigation Management (PIM) are generating some benefits from irrigation—including those towards alleviating poverty. Grants made to newly-constituted secondary and tertiary level organizations set up for Operation and Management tasks have created employment opportunities for the poor. Increased spending on infrastructure maintenance and devolution of management powers have increased reliability of water supply, reduced water theft, reduced disputes over water allocation, and reduced corruption, while increasing information sharing among farmers and empowerment of local communities.

However, the benefits from ongoing reforms have not been substantial in South Asian systems. This is mainly due to the following issues:

- Benefits largely emanate from rehabilitation grants or assistance. They are not sustainable because these grants are not regular.
- Where IMT is introduced as a management intervention, a necessary condition for its success is that irrigated agriculture is central to the livelihoods of the farmers involved (domain central). However, in many South Asian systems, this intervention has been superimposed upon groups who are finding agriculture increasingly unprofitable—and would like to exit from it given an option.
- In South Asia, reforms focused on infrastructure development, rehabilitation and maintenance work. Issues like developing effective mechanisms to ensure equity in water allocation, capturing the inputs of the poor in decision making processes, negotiating and establishing water rights (especially for the poor), and establishing accountability and incentives systems for optimal outputs.
- Water User Associations (WUA's) are 'single issue' groups (their mandate generally limited to fee collection or O&M). They need to be made more multi-functional and commercially oriented. Further, they seem to either maintain or strengthen the *status quo* in the socio-economic milieu. In Bangladesh and Pakistan, they exacerbate the power inequality between small and large scale farmers. In India, WUA leaders are reported to act more as contractors for water services than as farmer representatives. Further, there is significant gender inequality in the decision making bodies.

Figure 1: Factors affecting poverty impact of irrigation systems



Box 1: A few factors that work for the Chinese systems

- Marginal socio-economic disparities.
- Equitable distributes of resources (land and water).
- As a result of the above, productivities of most irrigated systems are comparably high.
- A 'Bounded service provider model' where a local entrepreneur, bureaucrat or economic entity is given incentives to effectively manage the system.
- A canny incentive structure for managers and service providers to ensure better service delivery.
- Positive incentives to service providers and managers for saving water.

The Chinese and to some extent the Vietnamese systems show maturity in their water management organizations. In Vietnam, Irrigation and Drainage Management Companies (IDMC) have been set up on commercial lines—necessitating them to be financially self-reliant.

Water rights and allocation

Customary rights over irrigation water are not amenable to addressing the poverty problem, because they are generally biased towards the larger and more powerful farmers. Formalized and secure water rights enable the poor to protect their access and entitlement to water. All stakeholders need to be involved in the negotiations towards formalized water rights. In this context, only the Chinese systems show allocation methods that are both formalized as well as flexible vis-à-vis local conditions.

Box 2: Types of Chinese water allocation systems

Equity based allocation: water is provided first to farmers located towards the tail and last to those at the head.

Efficiency based allocation: water managers irrigate as water flows in the canal. When the nearest fields are irrigated first, it becomes physically more efficient to allocate water further.

Capacity to pay based allocation: managers first provide water to those farmers who pay first.

However, where the Chinese as well as the Vietnamese allocation systems score over their South Asian counterparts, they need to address the problems arising

out of fragmentation of household land. The latter arises from their 'good with bad and near with far' policy of land allocation that scuttles effective functioning of WUAs – especially where scattered holdings necessitate households being members of multiple WUAs.

Pricing and cost recovery

Recovery of at least the O&M costs is vital to the overall health and productivity of an irrigation system. This study, as well as past studies, shows that under conditions of reasonable irrigation service fee, the incremental benefit from irrigation derived by the farmers is adequate to pay for the full O&M costs while retaining significant increase in net incomes due to irrigation. However, in most systems, Irrigation Service Charging (ISC) accounts for about three percent of the gross value of product per hectare. It typically represents less than 15 percent of average net productivity gains of irrigation³. Untargeted subsidies generally serve to widen the gap between the rich and the poor farmers.



Researchers in conversation with cotton farmers in Andhra Pradesh

In India, Bangladesh and Pakistan, ISC has hardly any relation to either the actual system O&M cost, or the quality of service delivery. The revenue collected goes to the treasury and O&M is funded through annual budgetary allocations. The system therefore supports no incentive for the service providers to utilize funds efficiently. It also breeds apathy among farmers that acts as a dampener to demands for better service provision. Irrigation charges are generally fixed by the government and are flat across the command area for all locations and all socio-economic groups. Under such circumstances, the disadvantaged sections end up subsidizing the privileged ones.

³Defined as net value of output from irrigated crop production less net value of output from non-irrigated crop production.

Box 3: Options for irrigation service charging

1. Area based charging
 - Flat rate per hectare of irrigated land with cap on farm total supplies through a defined entitlement.
 - Flat rate per hectare of farm with cap as above.
 - Flat rate for land needed for subsistence and progressively differential rate for land above that. Cap as above.
2. Crop based charging
 - Variable rate per irrigated crop hectare. Higher charge for more water intensive crops. Cap on farm total supplies through defined entitlement.
 - Variable rate per hectare for dry and wet seasons. Cap as above.
 - As above. In addition, a flat rate for land required for subsistence and progressively differential rate for land above that. Cap as above.
3. Volumetric charging: flat or variable rate per unit of water delivered to farms. However, this is not feasible in this context owing to the lack of water measuring systems at farm level.
4. Multi level, multi part charging
 - Volumetric charging at primary and secondary levels (where water delivery can be measured) with two components: (a) flat rate per hectare of command area irrigated and (b) flat or variable rate per unit of water delivered. Area or crop based charging at the tertiary level, where it is difficult to measure water flows.

The situation is better in China and Vietnam where charges in general are higher than in South Asia and cost recovery much healthier. Collection is generally higher where private contractors and active WUAs operate at the tertiary level under financial incentives towards better collection. They in turn use the carrot and stick approach to improve collections. Thus, strengthening accountability and transparency in the systems facilitate equitability.

Access to technology

Productivity enhancing and resource saving technology have the potential to increase the returns from farming for the poor. Improved systems of water delivery such as targeted lining and waterproofing of canals, improved water control structures; micro-irrigation systems such as rudimentary sprinkler and micro drip; treadle pumps; resource conserving technologies like zero tillage, laser land levelling, bed planting and alternate wet and dry method of rice cultivation are either already available or under experimental stages. Some of these technologies—like treadle pumps and rice intensification system—show a good fit with the poorer farmers. Others can be tailored to meet the requirements of the poor through either efficient institutional arrangements or rental markets. Barriers to

ready adoption of available and feasible technologies by the poor *inter alia* are uncertainty over irrigation supply, crop specificity, knowledge and technical skill, capital intensity, market access and marketing efficiency. Further, augmentation of technical and management skills is *sine qua non* for optimal adoption and performance of these technologies at farmers' hands. Geographical and socio-economic contexts of technologies have to be carefully chosen to maximize their chances of success at the early adoption stages, since failure through unplanned implementation can spell the death of even the most promising technology.

Infrastructure, backward and forward linkages

At a wider level, investment in physical and social infrastructure plays a crucial role in liberating the full poverty impact potential of irrigation systems. Connectivity (facilitating access to markets and information); education (raising managerial and entrepreneurial competencies of farmers); access to good seeds, fertilizers, credit; presence of efficient markets and access to competent marketing services have been found to be important determinants of success or otherwise of irrigation systems.

Level of corruption

Corruption in irrigation systems get manifested in many forms. O&M and canal lining works of poor quality, rent seeking by irrigation agency staff, water theft by locally influential persons, tampering with canal outlets, unauthorized extraction from canals and blockage of distributaries, underassessment of irrigated area and water charges etc. reduce the system efficiencies. Studies show no conclusive proof as to the effect of management reforms on corruption. The case of Pakistan shows that while reforms have led to some improvements like reduced rent seeking by irrigation officials, they have other problematic offshoots like nepotism, dominance of influential sections in management committees, lack of transparency in deployment of O&M funds etc. However, the probability exists that corruption has generally reduced over the last two decades consequent to expansion in groundwater and conjunctive use of surface and groundwater irrigation. On the other hand, the study bears out the fact that equity in resource distribution has a debilitating effect upon corruption.

How do we make irrigation pro-poor? Key policy messages

In perspective of the findings from the study, certain guidelines emerge for making irrigation systems pro-poor.

Is the entire gamut of hardware and software in place?

It takes an integrated approach. Project design, appraisal and interventions have to integrate physical irrigation system infrastructure with efficient and equitable resource distribution, water management, cost recovery and revenue outlay administration, connectivity, social infrastructure and access to inputs, credit and output markets for optimal systemic impacts on poverty alleviation. Management of surface and groundwater should be integrated.

Do the poor have resource access to profit from the interventions?

It takes pro-poor land and water rights that are feasible and at the same time significant in impact. For land, two options may be considered: (a) improving access of the poor to land through voluntary sale and purchase of land, with emphasis on provision of subsistence-size plots with returns adequate for supporting an average sized family, and (b) improving access to minimum viable land holdings for the chronic poor through redistribution of state lands and purchase of land from large land owners facilitated by NGOs and credit. For water, threshold supply norms for subsistence sized holdings may be introduced while allocating water rights to all households including the landless by partially de-linking land and water rights.

Catering first to those with the most pressing needs

Some need more urgent attention than the others. Poverty alleviation plans have to be tailored to fit different regions and socio-economic groups. Further, these regions and groups must be prioritized since they differ in their depth, breadth and nature of poverty. Some of the criteria of prioritization are irrigated or un-irrigated area, productivity of the system, location on the system (near head or tail), quality of groundwater, permanence of poverty, land ownership pattern, gender of the head of household, and caste composition.

Is poverty on top of the agenda at every stage?

Project feasibility study, design, monitoring, implementation and impact assessment need to be pro-poor. Poverty reduction effects of interventions have to be factored in at all the stages and levels of a project. Labour intensive methods of construction and rehabilitation of projects, and labour intensive methods of production should be promoted towards employment generation. A shift in emphasis from 'grow first' (as in most South Asian economies) to 'distribute first' (as in China and Vietnam) is needed.

Does water management have the right incentives to be self-sustaining and pro-poor?

The twin objectives of economic viability and poverty alleviation in water management have to be met through continuous performance evaluation vis-à-vis specific and realistic targets in infrastructure maintenance, financial self-reliance, equity in water allocation and distribution, water efficiency and productivity, environmental sustainability and poverty alleviation. An effective incentive structure needs to be put in place for WUAs and water managers to meet these targets. Lessons may be drawn from the Chinese and Vietnamese systems in this regard. Further, negotiated and formalized service delivery contracts should be encouraged to govern service provider–farmer dealings. Compensation clauses should cover cases of significant deficiencies in service levels. The irrigation fee structure should be ruled by 'market segmentation' as opposed to a flat rate. Multi-level and multi-part charging is a system of differential pricing amenable to it. Further, the poor must be significantly involved in water management activities and institutions.

Knowledge formation and dissemination

The knowledge base needs to be strengthened. Research and development on water, productivity and poverty issues in agriculture are crucial for expanding the knowledge base—and identifying contemporary best practices—on these issues. Institutionalizing the development of operational packages of knowledge and technologies, and establishing effective mechanisms for timely delivery of such packages at various levels should be an important strategy.

Specific areas for research and intervention

The study has come with country-specific areas where future work is necessary:

- China: water conservation and water usage efficiency to address water scarcity and competition across sectors for water.
- Vietnam: agricultural diversification to enhance value from agricultural activity and strengthening and integrating management institutions at various levels.
- Indonesia: agricultural diversification for increasing value and development of forward linkages.
- India: enhancing physical and economic productivity, expanding reforms and bolstering farmers' organisations by expanding their geographical, hierarchical and functional coverage.
- Bangladesh and Pakistan: equitable resource distribution and opportunities, enhancing physical and economic productivity in agriculture and institutional reforms in irrigation management.



Liuyuankou Irrigation System Rice crop cutting, China.

PHOTO CREDIT: Ronald Loueve

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IWMI is a non-profit scientific organization funded by the Consultative Group on International Agricultural Research (CGIAR). IWMI's research agenda is organized around four priority themes covering key issues relating to land, water, livelihoods, health and environment:

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- Theme 2: Land, Water and Livelihoods: *improving livelihoods for the rural poor*
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- Theme 4: Water Management and Environment: *balancing water for food and nature*

The Institute concentrates on water and related land management challenges faced by poor rural communities in Africa and Asia. The challenges are those that affect their nutrition, income and health, as well as the integrity of environmental services on which food and livelihood security depends. IWMI works through collaborative research with partners in the North and South, to develop tools and practices to help developing countries eradicate poverty and better manage their water and land resources. The immediate target groups of IWMI's research include the scientific community, policy makers, project implementers and individual farmers.

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