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Social Science Research and Development for Effective Management of Water Resources: Perspectives from IWMI's Research Agenda

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Abstract

This paper highlights the application of concepts and methods from social sciences by the International Water Management Institute (IWMI) to analyze problems and issues relating to the water sector. In many respects, the closing decades of the twentieth century stand out as the period when social-science research on issues relating to water, especially irrigation, became institutionalized. This arose primarily from the conviction of the need to apply modern management to irrigation and the stress placed upon the socioeconomic nature of irrigation, with incentives becoming a key issue. The International Irrigation Management (IIMI) was established precisely for determining non-engineering solutions to enhance the performance of irrigation systems, especially the large schemes owned and managed by government agencies, which were widely believed to be under-performing. The applications of concepts and methods from the social sciences were central to achieving IIMI's mandate. The transformation of IIMI to IWMI with a broader mandate encompassing the water sector and not merely on irrigation, strengthened the need for social-sciences applications. This paper traces the trajectory of social-science research in the transition from IIMI to IWMI.

In the formative years, the prime focus of IIMI's research was on issues at the main system level. The performance of canal-water delivery, institutional and managerial factors affecting water delivery, and agency-farmer relationships were some of the key issues that were addressed. Management science, organization theory and principles of public administration provided the conceptual underpinnings of the analytical frameworks that were adopted. The inclusion of issues relating to farmer-managed irrigation systems in the research agenda of the institute reinforced the application of social-science methodologies, especially for exploring the social organizations and institutions in traditional irrigation communities. The paper highlights the results of these studies and outlines their usefulness in formulating policy recommendations and interventions for improving the performances of the farmer-managed irrigation systems. Institutional reforms in the irrigation sector, especially the transfer of irrigation-management responsibilities from government to farmer organizations and interest in cost-recovery resulted in additional demands for social-science research. Research on issues relating to user fees, enabling conditions for collective action by farmers, gender impacts of irrigation-management reforms and the impacts of the reforms on the performance of irrigation schemes were some of the prominent issues that the social scientists addressed.

The transformation of IIMI to IWMI reinforced the need for the application of approaches and disciplines from the social sciences. The need to recognize the economic and social value of water, the social and environmental impacts of water-resources development, a comprehensive approach to problems of governance and policy making, the need for stakeholder consultations, gender issues and, more importantly, the renewed global concern on poverty and the need for more pro-poor interventions in the water sector were the prime drivers for greater application of social-science research methods. The paper highlights the range of projects that involved the application of social science research methods at IWMI.

INTRODUCTION

Four basic features shape the research agenda of the International Water Management Institute (IWMI). First, the primary focal point of IWMI's research on issues relating to the management of irrigation and water resources. Management is essentially a social process. Second, the research centers on relationships between water and people: farmers, irrigation agency personnel, women, poor people in rural and urban areas, and other water users and stakeholders. It is believed that better water management would increase the productivity of land and water, and empower poor people to improve their lives. Third, because of the emphasis on people-centered research, a key research method employed is interactions with people who are a major source of data and information and the beneficiaries of our research. Finally, IWMI's research laboratories are "real" irrigation systems and water basins of the world. These features make it imperative to utilize concepts and methods from social sciences in the research strategies and methodologies adopted by the institute.

This paper highlights the applications of social science concepts and methods at IWMI to analyze problems and issues relating to the water sector, particularly in irrigation management which has been a dominant component of IWMI's research agenda since the inception of the institute. The paper demonstrates that the transformation from an irrigation management institute (IIMI) to its present status of a water management institute (IWMI) with a broader mandate reinforced the need for social-sciences applications.

IWMI'S PROGRAM THEMES: PAST AND PRESENT

By early 1980s, it was becoming increasingly clear that the heavy investments in irrigation development in developing countries in the 1960s and 70s had, in many cases, not yielded benefits on the scale anticipated. The poor performance of the irrigation systems, especially the large schemes owned and managed by government agencies, was attributed to poor management. The "management gap" was perceived in terms of erratic and unequal distribution of irrigation water, poor maintenance of physical facilities, increasing incidence of water related conflicts among farmers, information gaps, negative environmental impacts and lack of trained irrigation managers. IIMI was set up to find solutions to the problems. Most of the work during the first decade sought to find ways to improve productivity and equity in the performance of surface water or canal irrigation schemes.

At the inception of the institute three research themes were defined: Systems Management, System Rehabilitation and Improvement and Farmer Managed Irrigation Systems. The first Medium Term Plan for 1994-98 prepared after the institute joined the CGIAR proposed five major research themes and four cross – cutting themes. The focus was primarily on the irrigation sector that continued to be considered as a high priority sector in water resources development.

By the mid-1990s there was a dramatic change in the understanding of issues relating to water resources both within the institute and world's scientists, policy makers and leadership. There was a greater appreciation of the emerging problems posed by growing scarcity and competition for water. Investments by international agencies and national governments in irrigation infrastructure, in operation and maintenance of irrigation systems, and in research for irrigated agriculture had shown a steady decline. Given the long gestation period for most irrigation improvements, there is a danger that underinvestment could lead in many regions of the developing world to a crisis in the supply of food and both quantity and quality of water. The emerging trends required new policies, technologies, institutions, and management systems. Both the mission and the Institute's name changed to reflect the new realities and problems arising as we enter an era of water scarcity. Since 1995, there has been a major shift in research focus - a "paradigm shift."

The salient features of the *new IWMI paradigm* are:

- The perception that, while irrigation will continue to be the dominant user of water, one cannot analyze irrigation and irrigated agriculture in isolation from other water uses and users. There is a growing need for policies and institutions based on integrated water resource management (IWRM).
- Closely related to IWRM, a basin-level approach to measuring water use efficiency is needed to take into account the multiple uses and reuses (recycling) of water for irrigation and other purpose.
- Basin- and system-level analyses must consider both groundwater and surface water irrigation and the links between the two.
- Increasing pressure on water resources including the need to recycle waste water leads to major deterioration in water quality although in some instances there may be beneficial affects for agriculture.
- Water scarcity is associated with growing problems of poverty, gender inequity, and environmental degradation. Attention must be given to *productivity, equity, and sustainability* in the use of water resources.
- In the chronically water-scarce and marginal areas, poverty persists. To reduce this poverty, ways must be found to make more effective use of rainfall and limited water supplies.

The foregoing features of the new research paradigm are reflected in the current research themes and projects that will continue to evolve. The major research themes at present are:

a. Integrated Water Management for Agriculture.

The objectives of this theme are to develop and apply new research methodologies for assessing and improving irrigation water management performance in an integrated water resource management framework; and identify key methodologies, processes, and actions that will contribute to poverty reduction and food and environmental security

b. Smallholder Water and Land Management Systems

This theme seeks to identify and promote appropriate smallholder water and land management systems, that help improve the rural livelihoods of poor men and women, and that drive increases in water productivity and conserve the environment.

c. Sustainable Groundwater Management

This theme seeks to develop and disseminate a more accurate and refined understanding of the socio-ecological value of groundwater, and highlight the nature and scale of the consequences of its unsustainable use. It also attempts to identify promising technologies and management approaches with potential to help achieve sustainable groundwater use.

d. Water Resources Institutions and Policies

The goal of this theme is to identify policies, legal and institutional frameworks, and organizational options that are most appropriate to enhance and sustain high productivity of water and land resources and contribute to the eradication of rural poverty. The theme also seeks to develop research-based guidelines for water policy reform, organizational options and roles, and support systems for the local management of irrigation that leads to more effective management of water in river basins

e. Water, Health and Environment

The goal of this theme is to work towards the incorporation of health and environmental safeguards in water resources planning and management by scientifically documenting the relationships between water, human health and ecosystems, and by developing practical solutions to mitigate adverse health impacts and sustain ecosystems whilst obtaining optimum agricultural production.

Each research theme has a separate focus but complements the work of the other four. Most of the research projects under the respective theme adopt a multidisciplinary approach, but there is a substantial social science input in themes 3 and 4 compared to other programmatic areas.

A sixth area is the Comprehensive Assessment which is not a research theme per se but an international program supporting research, capacity building and knowledge sharing with the objective of reducing poverty in the developing countries

ROLE OF SOCIAL SCIENCES

Given the multidisciplinary nature of most studies conducted by IWMI, it not possible or practical to isolate the specific theoretical frameworks and methodologies adopted in the various studies. Nevertheless, there is considerable evidence that applications of concepts and methods from the various branches of social sciences are central to the achievement of IWMI's mandate. The following sections summarize some of the key aspects of research projects in the past which involved a substantial application of concepts and methods from the social sciences.

Farmer Managed Irrigation Systems

Research on farmer managed irrigation systems has been an important item of research agenda since the inception of the institute. The main objective of the research was to understand the organization and functioning of these systems in order to find ways of supporting them improving their performance. IWMI's work in these area builds on important work of other scholars carried out over the past several decades notably the studies of Edmund Leach, Clifford Geertz, Walter Coward and more recently by Elinor Ostrom and the Workshop in Political Theory and Policy Analysis at Indiana University. Two key research questions have been addressed:

- What kind of institutional arrangement and management practices have proven effective and sustainable in traditional farmer managed irrigation systems
- What internal and external stresses are interfering with the performance and sustainability of farmer managed irrigation systems

Field work was done were primarily in Nepal and Sri Lanka, with some amount of empirical investigations carried out in the Philippines, Indonesia and Pakistan. Some of salient findings are as follows:

- Traditional FMIS develop rules gradually over periods of negotiation and experimentation
- Rule compliance and leadership are more effective when rules are established by the irrigators themselves
- Socio-economic differentiation within the community weakens rule compliance

- FMIS generally use less formal sanctions (e.g. public shame) for rule breakers
- Water laws and policies related to FMIS sector are poorly developed
- The most common threats to institutional viability of FMIS are socio-economic differentiation and non-participatory public interventions (Merry, 1997)

IWMI has also developed information systems based on farmers' knowledge and perceptions. Participatory Rural Appraisal techniques and methodologies for socio-economic profiling have been developed applied to action research programs aimed at strengthening support services

Studies on Gender Issues

This is an area that is almost exclusively in the domain of social sciences. Research in this area was focused on exploring the links between gender and water deprivation, especially women's access to water for income generating activities like irrigated farming, as well as domestic purposes. Several case studies have been conducted involving intense field work. A variety of social science research methods were employed to collect data. The studies are mostly qualitative analysis gender relationships at the household, community and irrigation system level. A study on participation of female farmers in the farmer organizations (FO) of minor irrigation systems in Sri Lanka identifies factors that hamper the participation of women in decision-making processes with regard to land, cultivation and irrigation. The study argues that participation does not necessarily result in equity and that other forms of equity interact with gender inequity in the FOs (Van der Molen 2001)

An assessment of lift irrigation schemes in East Gujarat, India study highlights the gender aspects of a community-based irrigation program supported by the NGO, Sadguru. It focuses on the intra-household organization of irrigated agriculture, the gender dimensions of scheme-level irrigation management, and Sadguru's efforts to strengthen women's participation in irrigation cooperatives (Saini and van Koppen, 2001)

A study of the Women's Irrigation Group of Jambar, South Gujarat documents a "best practice" - a successful gender-balanced irrigation intervention in which women were given control over an irrigation technology. The study evaluates the approach taken by the implementing NGO, the Aga Khan Rural Support Programme, in terms of its replicability in other areas where women share in farm activities and decision making.

A recent study looks at how integrated water management policies can strengthen poor women's and men's access to water, for irrigation and other domestic or economic uses. Evidence suggests that in developing countries, in most situations, poor women disproportionately bear the burden of the unpaid chore of fetching water for domestic use, while they are denied opportunities to use water to generate incomes. Women's lack of access to water for income generation is a major concern of the IWMI gender project. Rights to irrigation water are a pressing need for poor women throughout the developing world. Many farm their own plots, either as the sole supporters of their families or as important supplements to their husband's incomes. Irrigation agencies have often overlooked the needs of these women farmers. Some irrigation improvement projects have even taken away the access that women had previously.

Although gender issues priority areas in the agendas of irrigation policy makers, interventionists, farm leaders and researchers, there is still a considerable gap between positive intentions and concrete action. An important but hitherto ignored reason for this is the lack of adequate generic concepts and tools that are policy-relevant and can accommodate the vast variation in irrigation contexts worldwide. The Gender Performance Indicator for Irrigation aims to fill this gap. In any particular scheme, this tool diagnoses the "gendered" organization of farming and gender-based inclusion or exclusion in irrigation institutions. It informs irrigation agencies what they themselves can do for effective change-if necessary. The tool also identifies gender issues beyond a strict mandate of irrigation water provision. The Indicator was applied and tested in nine case studies in Africa and Asia. (van Koppen, 2002)

Institutional Reforms in the Irrigation Sector

Research under this theme covered a range of topics that included farmer participation in irrigation management, participatory irrigation management and irrigation management transfer. Studies on irrigation management transfer dominated IWMI's research agenda for about a decade and the volume of work done in this field is substantial. It is a topic that consumed the time of most of the social scientists at IWMI. The research focussed on four broad areas:

- The process of management transfer
- Preconditions for viable management transfer
- Appropriate organizational models
- Impacts of transfer on the performance of irrigation and irrigated agriculture

The bulk of the work on irrigation management transfer are country specific studies. While the earlier studies varied in conceptual design, studies carried out in later years adopted a common methodology to facilitate comparative analyses.

Research to date and reports from practitioners in international meetings favor the notion that certain prerequisites are needed before countries can expect to achieve success with management transfer programs. The most common are

- a clearly recognized and sustainable water right and water service
- infrastructure that is compatible with the water service and local management capacities
- well-specified management functions and assignment of authority
- effective accountability and incentives for management
- arrangements for viable and timely conflict resolution
- adequate resources that can be mobilized for irrigation

The conclusion that emerges from the collection of studies is that the impacts of irrigation management transfer are somewhat disappointing. There have been no dramatic improvements in performance following transfer and the gains are modest relative to the efforts made.

Economic Issues

Resource Mobilization and Cost recovery

A key item of the institute research agenda is the issue of cost recovery in the provision of irrigation services. Earlier research on the relationship between how irrigation services are financed and the level of the service. The delivery of irrigation services by agencies that are able to finance a fair proportion of the cost of service from irrigation fees provide a higher standard of services. Studies carried out in Egypt comparing three methods of water fee collection: flat area fee, crop-based charges, and volumetric fees found that there was hardly any difference in collection rates, or farmers decision makings and water use efficiency. The cost of institutional arrangements and infrastructure development for the latter two options makes them economically infeasible.

A more recent study on the use of water charges to generate resources for maintenance and to reduce demand. It is argued that in developing countries, the facilities required for measured and controlled delivery of irrigation are rarely in place, and would require a massive investment in physical, legal and administrative infrastructure. To be effective in curtailing demand, the marginal price of water must be significant. Using data from Iran the study demonstrates that the price levels required to cover operation and maintenance (O&M) costs are too low to have a substantial impact on demand, much less to actually bring supply and demand into balance. On the other hand, the prices required to control demand are unlikely to be within the politically feasible range. The study argues that water supplied is a proper measure of service in domestic and industrial uses. But in irrigation, and especially as the water resource itself becomes constrained, water consumption is the appropriate unit for water accounting. This is exceptionally difficult to measure. An alternative approach to cope with shortage would focus on assigning volumes to specific uses-effectively rationing water where demand exceeds supply. This

approach has a number of potential benefits including simplicity, transparency, and the potential to tailor allocations specifically to hydrological situations, particularly where salinity is a problem (Perry, 2002)

Public Investments in Irrigation Development

A recent study attempts to analyze the investment trends in irrigation in Sri Lanka . The paper begins by tracing the development phases of irrigated agriculture. Three phases are defined. The first phase represents the early stage of agricultural development when land resources are abundant and agricultural output is increased by opening new land . The second phase represents the construction of new irrigation facilities as irrigation development becomes a more profitable base for agricultural growth than the opening of new land. The third phase involves enhancing the performance of the existing irrigated land base by various interventions such as rehabilitation and modernization of existing irrigation systems, improvement of irrigation performance through better management, particularly with greater farmer participation in the operation and maintenance (O&M) of the systems, groundwater development, and conjunctive management of surface and groundwater. The paper argues that Sri Lanka's irrigated sector is in the third development phase.

From the early 1980s to 1990s total public sector investments in the irrigation sector showed a sharp decline. There was also a decline in terms of the proportion of public irrigation investments relative to government budget, and investments in irrigation by donor agencies. New irrigation construction recorded the sharpest decline. Investments on irrigation rehabilitation that commenced in the mid-1970s, reached a peak mid-1980s and subsequently declined. A salient feature of the irrigation sector in Sri Lanka during the last decade is the rapid spread of groundwater abstraction by farmers by constructing of agricultural-wells using small irrigation pumps. Investments in agricultural wells and pumps are largely investments made by individual farmers. Private irrigation investments which was insignificant in the early 1970s now accounts for about 20% of the total irrigation investments. Estimated Social Internal Rates of Returns for different types of agricultural-well investments vary from 28 to 500% which suggests that investments in wells and pump generate positive benefit to society. The social rates of return to farmers' investments on agricultural-wells and pumps are apparently superior to those in public irrigation investments.

Global Forecasts of Water Supply and Demand

It is widely recognized that many countries are entering an era of severe water shortage. IWMI launched a long-term research program to determine the extent and depth of this problem, its consequences to individual countries, and what can be done about it. Towards this end IWMI has developed a model ((PODIUM) for estimating future water supply and demand that tries to build on the strengths, while overcoming the limitations, of previous methodologies. Using the model data is generated on water supply and demand for 118 countries that include 93 percent of the world's 1990 population. Two scenarios of world water supply and demand are presented. The first is a base case, or

"business as usual," scenario. The second scenario assumes a high, but not unrealistic, degree of effectiveness in the utilization of irrigation water, with the consequent savings of irrigation water being used to meet the future water needs of all the sectors. It is found that the growth in world requirements for the development of additional water supplies varies between 57 percent in the first scenario to 25 percent in the second scenario. The truth perhaps lies somewhere between. Thus increasing irrigation effectiveness reduces the need for development of additional water supplies for all the sectors in 2025 by roughly one-half. Detailed findings of the study are given in Seckler *et al* (1999). The Institute's work in this area, gives planners a micro-to-macro view of their water resources, from the farm, irrigation system and river basin levels. This basin-level perspective gives a clear picture of the multiple uses for water and the interactions between the different users.

These findings will support the creation of future international water policy. They will also help identify priority areas for research where the international water and development communities can focus their resources for best results

Concluding Remarks.

This paper highlighted the application of concepts and methods from social sciences by the International Water Management Institute (IWMI) to analyze problems and issues relating to the water sector. Given the multi-disciplinary approach adopted in most studies it is not possible or practical to isolate specific theoretical frameworks used in most studies. Nonetheless, the research projects highlighted in the paper indicates the wide range of topics to which social science concepts and methods have been applied. These include household level analyses of issues relating to gender and water, community level studies on farmer managed irrigation schemes, at the sector level in the analysis of institutional reforms in the irrigation sector, macro-level for issues relating to cost recovery and trends in irrigation investments, and at the global level analyses of future supply and demand for water.

There are clear signs of social sciences gaining importance in the research agenda of IWMI. The recognition that the river basin is the most appropriate geographical unit for developing and managing water resources not only broadens the physical domain in which analyses are conducted, but also requires dealing with a larger and diverse group of water users and stakeholders. In addition, the high priority given to poverty eradication has resulted in major challenges, especially in the light of the growing scarcity of water problems, which in many developing countries is already placing a severe burden on poor people. There is a growing demand for the Institute to play an important role in clarifying and solving water scarcity issues and thereby contributing to improved food security and welfare of the poor people living in water-stressed, poverty-stricken environments. Increasing the physical supply of water is only part of the solution. There must be effective mechanism for improving the access of the poor and the disadvantaged people to safe water. These requirements will prompt a greater need for

the application of social science research methods for the analysis of problems in the water sector, especially with the need to engage in more micro-level studies on various socio-economic issues.

In terms of social science research capacity, around 35% of the internationally recruited research staff are social scientists. Economists account for half the number and the rest with formal training in other social science disciplines: there 2 anthropologists and 2 sociologists and others with formal training in various combinations of social science subjects. The ratio of social scientists to non-social scientists has been fairly stable throughout IWMI's existence, except for a brief period in the late 1990s when some of the more technical issues dominated the research agenda of the institute. In addition, there are many nationally recruited social scientists who employed for various country specific assignments.

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