RESEARCH REPORT

106

Assessing the Outcomes of IWMI's Research and Interventions on Irrigation Management Transfer

Meredith A. Giordano, Madar Samad and Regassa E. Namara

International Water Management Institute

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Cover photograph: A Water User Association meeting in Nepal.
Photo credit: IWMI-Information and Knowledge Group (IKG) photo collection.

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Contents

Acronyms and Abbreviations

ACTED	Agency for Technical Cooperation and Development
CARE	Cooperative for Assistance and Relief Everywhere
CGIAR	Consultative Group on International Agricultural Research
CGNET	CGIAR Network Services International
FAO	Food and Agriculture Organization of the United Nations
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH
IIED	International Institute for Environment and Development
IMD	Irrigation Management Division
IMPSA	Irrigation Management Policy Support Activity
IMT	Irrigation Management Transfer
ISP	Internet Service Provider
IWMI	International Water Management Institute
NARES	National Agricultural Research and Extension Systems
NGO	Non-Governmental Organization
NRM	Natural Resources Management
O&M	Operation and Maintenance
PIDA	Punjab Irrigation and Drainage Authority
PSM	Privatization and Self Management of Irrigation
SCOR	Shared Control of Natural Resources
SIC ICWC	Scientific-Information Center: Interstate Commission for Water Coordination
SIDA	Sindh Irrigation and Drainage Authority
FO	Farmer Organization
USAID	United States Agency for International Development
WUA	Water Users Association
WUF	Water User Federations

Abstract

Irrigation management transfer (IMT) served as the cornerstone of the research agenda of the International Irrigation Management Institute (IIMI) and later, the International Water Management Institute (IWMI) for nearly a decade. The research theme arose for IWMI in response to the growing evidence of under-performance by publicly owned irrigation schemes and widespread belief that the transfer of management responsibilities to farmer organizations could improve the management of irrigation systems and make irrigated agriculture more productive and sustainable. IIMI/IWMI contributions to the topic included literature reviews and analyses of experiences and impacts of past IMT processes, advice to policymakers in planning and implementing IMT, and the development of generic IMT guidelines and technical support for governments implementing IMT programs. The purpose of this paper is to summarize IIMI/IWMI's past research and interventions related to irrigation management transfer and to document, to the extent possible, the academic, policy, and technical outcomes of these efforts. The application of a range of direct and indirect measurement techniques suggests an overall positive contribution from IWMI to IMT theory and application. Bibliometric and webmetric analyses suggest a large and continuing demand for IWMI research products on IMT. Direct and indirect data sources also indicate that IWMI policy and operational level interventions have in general contributed positively to IMT decision-making and action, both nationally through action research projects as well as regionally and globally, through the development of generic IMT guidelines. Finally, the continued demand for IWMI involvement in IMT action research serves as an important indicator of IWMI's past contributions.

Assessing the Outcomes of IWMI's Research and Interventions on Irrigation Management Transfer

Meredith A. Giordano, Madar Samad and Regassa E. Namara

Introduction

A key recommendation following from the Earth Summit held in Rio de Janeiro in 1992 was that water management should be decentralized and farmers and other stakeholders should play a more important role in the management of natural resources including water (United Nations 1992). Even before the Earth Summit, countries with sizeable irrigation sectors were transferring the management of irrigation systems from government agencies to water user associations or other local non-governmental organizations. This phenomenon which became known as irrigation management transfer (IMT) entails the partial or complete transfer of irrigation management rights to and responsibilities for an irrigation (sub) system from government to farmer organizations, water user associations (WUAs), other non-governmental agencies (including the private sector) or local government agencies. The growing interest in IMT stemmed in part from the assumed efficiency and productivity gains due to farmer participation and the decentralized management of irrigation systems. It was also assumed that the transfer of management responsibility to local organizations would improve the accountability of the irrigation service to farmers, improve the cost effectiveness of service provision, motivate farmers to invest more in maintaining irrigation systems and, ultimately, make irrigation systems and irrigated agriculture more sustainable. In addition, shortfalls in government funds to finance the recurring costs of irrigation and the inability to recover costs from farmers further encouraged many developing countries to adopt IMT reform programs.

Despite widespread interest in irrigation management turnover, however, there was very little documentation about the processes used and the impact of the transfer in terms of efficiency and productivity gains. Many policymakers, development agencies and water user associations were searching for viable management options, but were constrained by the lack of experience and information. Further, there was uncertainty and some skepticism about the effects the changes would have on management performance. As a result, there was an urgent need for a systematic, comparative assessment of the range of approaches being used, constraints on implementation, and the impacts on performance from transferring irrigation management to local institutions. There was also a growing demand for information on supportive legal, policy and regulatory frameworks, and about the suitability of different turnover processes in differing political, social and economic settings.

To respond to this need, the International Water Management Institute (IWMI), formerly the International Irrigation Management Institute (IIMI), launched a series of projects at the global, regional and national levels that reviewed and analyzed past IMT experiences and impacts. As a research institute, IIMI/IWMI's role was not to advocate IMT but rather to

objectively assess the extent to which the institutional innovation enhanced the performance and sustainability of irrigation schemes. Based on its research, IWMI then developed a series of 'products' including policy and operational recommendations to assist governments and local institutions that had decided to pursue IMT. Complementing the country-specific recommendations, IWMI also produced international public goods in the form of generic guidelines for IMT in general and for the establishment of water user associations in particular. The purpose of this paper is to summarize IIMI/IWMI's past research and interventions related to irrigation management transfer and to document, to the extent possible, the academic, policy, and technical outcomes of these efforts. We begin with an overview of IIMI/IWMI's past contributions to IMT research and practice. We then describe the objectives and related methodology for assessing the outcomes from this body of work together with the related results. The paper concludes with lessons from this particular study together with recommendations to improve future analyses of research outcomes and impacts.

IWMI's Contribution to the Knowledge Base on IMT

The first phase of IWMI's research on IMT focused on the analysis of past experiences and the resultant impacts from irrigation turnover. Although IMT was occurring, there had not been any systematic study of the process and outcomes. Hence, IWMI sought to fill this knowledge gap through in-depth case studies conducted at the regional scale, beginning with Asia and Latin America and thereafter assessing the implications for Africa. Further work was done at the household scale in terms of examining the gender related impacts of IMT.

Analysis of IMT Experience in Asia

In response to the growing demand for information on irrigation management transfer, IWMI (then IIMI) started the Privatization and Self Management of Irrigation (PSM) Program in 1992. The program was funded initially by the German Government and subsequently by IWMI's core funds. The overall objective of the program was to investigate the experiences and approaches to IMT in various countries, analyze the factors that contributed to its success or failure, and from that, develop appropriate recommendations to enable national, local, and donor organizations to make better management decisions and achieve more sustainable and productive irrigation. IWMI's role was not to advocate turnover, privatization or even self-management, but to objectively assess the results and to identify effective institutional strategies. IWMI felt well placed to undertake a study on this subject due to its expertise in irrigation management, especially on institutional issues; its worldwide network which enabled it to compare and contrast experiences across political, environmental and socio-economic boundaries; and its ability to access, analyze, and disseminate information globally.

More specifically, the PSM program sought to answer the following questions:

- What are the main strategies for IMT that are being implemented worldwide?
- What are the impacts of these IMT strategies?
- How should IMT be organized and implemented to produce successful results?

The evaluation began with an extensive review in which findings from 29 research studies on irrigation management transfer were summarized and evaluated (Vermillion 1997). This was followed by a series of country-specific studies in Asia, Latin America, and in a limited number of cases in Africa (table 1). While the initial studies varied in conceptual design, a standard methodology was later adopted in an effort to facilitate comparative analyses.[1] Most studies used a 'before-after transfer' and 'with-without IMT' framework for assessing the impact of management transfer on equity, efficiency, cost recovery, agricultural productivity and sustainability of irrigation system using various farm/system level indicators. Reports from stakeholders and post-facto assessments of single cases were also used. Annex 1 summarizes the results of IIMI/IWMI's case studies on IMT impacts.

The results from the various IWMI case studies suggested that, with the exception of Mexico and Colombia, the impact of IMT was mixed. In most Asian countries studied, the main change was a gradual decline in government financing of operation and maintenance of irrigation systems. There were also indications that WUAs were making only modest contributions towards maintenance, which raised concerns about the long-term sustainability of transferred irrigation systems. Again, with a few exceptions, no discernible evidence was found on the positive impacts of IMT on system operations and maintenance. Evidence relating to agricultural productivity was also mixed. In Sri Lanka, for example, significant increases in water productivity were found consequent to the rehabilitation and establishment of farmer organizations in the Gal Oya irrigation system, one of the first systems in the world where IMT was introduced (Uphoff 1992; Murray-Rust et al. 1999). Conversely, in Colombia, IMT was found to improve management efficiency and the accountability of agency personnel to water users but had no recognizable effect on agricultural productivity (Vermillion and Garcés-Restrepo 1998).

However, even where the impacts on agricultural or water management performance were not spectacular, the development of farmer organizations together with associated changes in government irrigation departments has been shown to contribute to the broader empowerment goals of reform (Uphoff et al. 1991). In Bangladesh, for example, IWMI research found that IMT reforms led to certain other positive impacts. Here, the focus of the policy reforms

TABLE 1.
The IMT case studies of IWMI.

Case study region/type	Reference
Overviews	Vermillion and Johnson 1995; Vermillion 1997; Vermillion 1998.
Latin America	Vermillion and Garcés-Restrepo 1996; Johnson 1997; Kloezen et al. 1997; Vermillion and Garcés-Restrepo 1998.
Asia	Mandal and Parker 1995; Bandaragoda and Memon 1997; Bandaragoda 1999; Brewer et al. 1999; Murray-Rust et al. 1999; Samad and Vermillion 1999; Vermillion et al. 2000; Naik et al. 2002.
Africa	Samad et al. 1995; Abernethy et al. 2000; Shah et al. 2001; Shah et al. 2002; McCornick and Merrey 2005.
Gender and Poverty Studies	Athukorale and Zwarteveen 1994; Zwarteveen 1994, 1995a, 1995b, 1995c, 1997a, 1997b; Zwarteveen and Neupane 1996; Jordans and Zwarteveen 1997; Buechler and Zapata (eds.) 2000; Van Koppen 2002; Van Koppen et al. 2002.

[1] The methodology is described in Vermillion et al. 1996.

was on the lift irrigation sector. Bangladesh's policy entailed the transfer of equipment and inputs from the public to the private sector; liberalization of equipment imports; withdrawal of subsidies on equipment; and the sale of publicly owned pumps to user groups. The first of these policy changes led to the rapid growth of shallow tubewells and to some extent, low lift pumps. Liberalization led to an expansion in the availability of irrigation equipment and a significant reduction in prices. As small farmers form a growing proportion of pump owners, the availability of inexpensive equipment in a range of sizes enabled them to increase their purchases. Moreover, both male and female rural workers seemed to have benefited from increased employment opportunities resulting from the expansion of irrigation (Mandal and Parker 1995).

'Limits to Leapfrogging': Prospects for IMT in Africa

In Africa, IWMI researched irrigation management transfer issues in Niger, Nigeria, and Sudan. In Niger, IWMI investigated the institutional and financial viability of the systems transferred to farmer cooperatives (Abernethy et al. 2000). In Nigeria, IWMI worked with a river basin management authority to pilot test a participatory action research approach to organize farmers based on experiences in Asia (Merrey 1997). IWMI's work in Sudan focused on the transfer of pump irrigation schemes along the White Nile to farmers (Samad et al. 1995).

Following these initial case studies on IMT in Africa, IWMI then launched a broader assessment (Shah et al. 2002) on whether the lessons from successful IMT cases in Asia, Latin America and elsewhere could be replicated in Africa.[2] Based on a comparative study of the experience of several countries, the authors found that nowhere in Africa does there exist a significant body of positive experience to suggest that traditional approaches to IMT will work in the African context of largely smallholder irrigation schemes. In many respects, the sub-Saharan African smallholder context differs from the situations found in areas where IMT has proven successful, such as in the USA, Mexico, Turkey and New Zealand where large-scale irrigation schemes predominate. The study argued that even if basic 'process' pre-conditions (supportive legal-policy framework, secure water rights, and local management capacity building) are met, IMT is unlikely to work for African smallholders. Rather, the authors recommended a set of institutional alternatives that address the complex set of constraints faced by African smallholders. A prerequisite for successful IMT was found to be enhanced income-creation potential of smallholder irrigated farming by strengthening market access, promoting high-value crops, and improving systems for providing extension and technical support to smallholder irrigators. IWMI research thus suggested that a multifaceted approach, rather than one focused exclusively on the direct transfer of irrigation management, was the key to any possible future success of IMT in the region.

IMT and Gender [3]

While the studies in the previous section referred to "farmers" as a single group, IWMI research has also focused on the impact of IMT policies at the household scale to assess both the role of women in irrigation management as well as the impacts of IMT on female farmers. IWMI research on the topic began in 1993 with literature reviews (e.g., Zwarteveen 1994, 1995a, 1995b, 1995c, 1997a, 1997b) and specific case studies in Bangladesh, Nepal, Sri Lanka and Burkina Faso to analyze the role of women in

[2] See also McCornick and Merrey 2005.

[3] See Merrey 1997, pp. 149-155 for a concise summary of International Irrigation Management Institute's (IIMI) research on gender and irrigation management.

irrigation management (e.g., Zwarteveen and Neupane 1996, Athukorale and Zwarteveen 1994). The results of this research suggested that while most studies on irrigation management refer to a uniform water user (male or female), in reality at the household scale, men and women often assume very different roles in water management, which can be parallel, complementary, or even in conflict with one another. As a result, the interests and impacts of irrigation management transfer can vary significantly across gender groups. Yet, in many cases women are excluded from official representation in farmer organizations and thus their concerns and interests are not taken into account (Merrey 1997). IWMI research thus concluded that "women's exclusion…, is 'deeply constraining' and the simultaneous empowerment of men in local communities and dis-empowerment or marginalization of women may have serious impacts on women's well-being" (Merrey 1997). Similar findings were also noted in a more recent study in Mexico on gender and irrigation (Buechler and Zapata 2000), in which research in the Bajío and the Lagunera regions again stressed the important, yet often invisible, role of women in irrigated agriculture.

While one of the key objectives of the research studies noted above was raising awareness among irrigation managers, policymakers, farmer leaders and researchers about the role of gender in irrigation, it soon became clear that there was also a need to help translate positive intentions into concrete action. There was, however, a lack of adequate generic, policy-relevant concepts to accommodate the vast variation in irrigation contexts worldwide. To fill this gap IWMI pioneered the Gender Performance Indicator for Irrigation (Van Koppen 2002). This sociological tool diagnoses the gendered organization of farming and gender-based inclusion or exclusion in irrigation institutions. It informs irrigation agencies as to what they can do to support effective change, if necessary. The tool also identifies gender issues beyond a strict mandate of irrigation water provision. The Indicator has been applied and tested by IWMI in nine case studies in Africa and Asia, and serves as one of the few gender studies that offers a practical tool to guide the interventions of policymakers, NGOs and senior irrigation managers wishing to achieve greater gender equity in their development projects.

The IMT Interventions of IWMI

Despite the uncertainties of its economic and social benefits, IMT continued and continues to be a major component of institutional reform programs worldwide. The State of Andhra Pradesh in India, for example, has implemented an ambitious program to transfer the management of the bulk of the state's irrigated area to water user groups. The state authorities are now considering additional reforms that are needed to realize the full benefits of IMT. South Africa recently launched a program to transfer publicly managed irrigation schemes to farmer organizations. Moreover, IMT efforts are currently underway in Central Asia, transitional economies of Southeast Asia, and several countries in Eastern Europe. Thus, given the continued demand for IMT programs, IWMI moved into a second phase of IMT research in which the Institute became more actively involved in drawing from past lessons (box 1) in an effort to promote more effective and sustainable implementation of IMT programs in the future. We summarize below IWMI's key policy-level interventions together with IWMI's involvement in actual IMT planning and implementation in Asia and Africa.

Box 1: IWMI Recommendations for Effective Irrigation Management Transfer

Based on its analysis of global IMT experiences and impacts, IWMI developed and applied through its projects a set of recommendations to promote more effective IMT planning and implementation. These recommendations were later formalized into IMT guidelines, which are described in more detail below.

Contextual Prerequisites

1. Strong political commitment to improve the performance of irrigation schemes through water user associations.
2. Legal and regulatory frameworks for sustainable water management.
3. Infrastructure that is compatible with the water service and local management capacities.
4. Complementary programs aimed at enhancing the income-creation potential of smallholder farmers in order to support the additional cost and responsibility associated with farmer managed irrigation systems.

Organizational Structure

5. Clearly defined management functions and assignment of authority, which takes into account the rights and responsibilities of both male and female farmers.
6. Replacement of administrative organizations with accountable service delivery organizations.
7. Recognition of irrigation systems as multi-use water service systems that function within a framework of integrated river basin management.
8. Viable and timely conflict resolution mechanisms.

Empowerment of Water User Associations

9. Clear rights of WUAs to use and maintain irrigation infrastructure.
10. Clearly recognized and sustainable water and land use rights.
11. Authority of WUAs to mobilize resources for O&M, including the right to levy irrigation service fees from farmers.
12. Federations of WUAs at the main irrigation system level and representation of WUAs in river basin councils.

Support Services and Capacity Building for WUAs

13. Formal responsibility of irrigation agencies to build capacity and provide support services to WUAs, including:
    - 13.1. Demand-driven agricultural extension assistance.
    - 13.2. Fair access to markets and related information.
    - 13.3. Financial and technical assistance for repair and improvement of irrigation structures.
    - 13.4. On-the-job training of WUA leaders in financial management, bookkeeping and simple accounting; preparing irrigation service plans and O&M budgets; determining appropriate levels of irrigation service fees; conducting financial audits; and applying new management tools.

Policy Level Interventions

Over the years, IWMI has supported IMT policy development in several countries in Asia and Africa. The most substantial involvement was in Sri Lanka through the Irrigation Management Policy Support Activity (IMPSA) in the early 1990s. IMPSA was a pioneering effort to institutionalize IMT. The project was launched in collaboration with the then Ministry of Lands, Irrigation and Mahaweli Development and the United States Agency for International Development (USAID), which funded the activity together with IWMI core support. The purpose of the project was to develop the Government of Sri Lanka's participatory irrigation management policy,

and it brought together national and international researchers and practitioners as well as local farmer representatives. The project resulted in several policy papers and special reports, which served as the key reference documents in a series of policy dialogues facilitated by IMPSA. In addition, over 50 working papers were reviewed and discussed at several workshops in an effort to create broader consensus for the proposed policies and implementation procedures (Merrey 1997). The recommended policies covered joint management and transfer arrangements to enhance farmer participation in irrigation management and financing policies. Further, the IMPSA policy papers recommended a restructuring of the nearly century-old Irrigation Department and the establishment of an Irrigation Management Division (IMD) to implement the national IMT policy.

Beyond the IMPSA project, IWMI was also involved in IMT policy development in Nepal. As in Sri Lanka, IWMI provided policy advice for a national IMT program with support from the Ford Foundation in the mid-1990s. As part of the project, IWMI was requested to provide recommendations to be disseminated through research reports, policy briefs and workshops on IMT processes and policies to promote a more effective transfer of management responsibilities. IWMI was also invited by USAID and the Nepali Ministry of Public Works of Egypt to assist the Ministry in planning and implementing a policy for cost recovery and financing irrigation services (Merrey 1997).

More recently, IWMI has offered assistance to the Governments of Cambodia and South Africa to support irrigation management reforms. In Cambodia, at the request of the Ministry of Water Resources and Meteorology, IWMI has been formulating a strategy for implementing participatory irrigation management and development. In South Africa, IWMI has worked closely with a range of local partners and has been instrumental in assisting the government in the development of water resources management and agricultural water use policies to empower historically disadvantaged smallholder farmers and other agricultural water users, and in particular, women and children in the former homelands of South Africa. While IWMI has been involved in many aspects of the policy reformulation, its specific IMT related contributions include policy-focused research outputs concerning the transformation of former white Irrigation Boards to more inclusive Water User Associations and Catchment Management Agencies.

Operational Interventions

In addition to policy-level interventions, IWMI has also been involved in action research projects to support the implementation of IMT policies. Within this area of research, IWMI participated in two major projects in Pakistan and Sri Lanka. In the former, IWMI launched four pilot studies between 1995 and 2000 to establish Water User Federations (WUFs) at the distributary canal level in the Punjab and Sindh provinces. In the Punjab province, the pilot WUF was established in the Hakra 4R Distributary, which was followed by pilot WUFs in three selected distributary canals in the Sindh Province. The pilot project in the Punjab was carried out in collaboration with the Punjab Irrigation Department with support from the Government of the Netherlands. The three pilot WUFs in the Sindh were similarly in collaboration with the Sindh Irrigation Department and the Provincial On-Farm Water Management Directorate with support from the World Bank (Bandaragoda 1999; Jehangir pers. comm. 2004).

In Sri Lanka, the IMPSA participatory policy development methodology described above was used to develop a USAID/Government of Sri Lanka-funded watershed management project entitled Shared Control of Natural Resources (SCOR), which was implemented over the period 1993 to 1998. Though not a specific IMT project *per se,* the SCOR project served to complement IWMI's IMT efforts to promote stakeholder participation in watershed management. The overall objective of SCOR was to improve livelihoods and the natural resource base within

the study sites and beyond by generating generic institutional lessons for the shared management of land and water resources. The basic premise of the project was that a progressive increase of users' share of control over natural resources (particularly land and water) is a vital means of guaranteeing more productive, profitable, equitable, and sustainable agricultural production. IWMI implemented the project in two watersheds in Sri Lanka. Within the two study sites, the project aimed to test appropriate technologies, organizations, strategies and approaches for reducing or removing identified constraints on sustainable productivity in rural watersheds. Simultaneously, the project sought to strengthen the capacities of local and provincial level institutions while creating an overarching national policy framework in support of the shared control of natural resources management. While the project contained elements of research, it was in many respects a development project implemented by IWMI and thus represented a non-traditional role for the Institute.

To a lesser extent IWMI also worked with the Governments of Indonesia and Nepal in the implementation of IMT reform programs. Unlike Pakistan and Sri Lanka, however, IWMI's role was confined to monitoring and evaluating the transfer processes. In both cases, IWMI concentrated its efforts on the broader institutional support mechanisms needed to foster more effective transfer processes.

IMT Guidelines

Finally, to capitalize on the lessons learned from the past IMT experiences and to make the information more broadly available, IWMI also developed a series of generic decision-making and operational guidelines for IMT and the establishment of water user associations. In terms of general IMT reform, IWMI and the Food and Agriculture Organization of the United Nations (FAO) produced a handbook entitled *Transfer of Irrigation Management Services: Guidelines* (Vermillion and Sagardoy 1999). The publication draws upon IWMI's worldwide experience with irrigation management transfer. The manual offers guidance to policymakers, planners, technical assistance experts and other stakeholders as to the conditions under which a country should adopt an IMT program and the principles and methods for effective design and implementation. More recently, IWMI together with the Scientific Information Center: Interstate Commission for Water Coordination in Central Asia, with the support of the Swiss Agency for Development and Cooperation, published guidelines for establishing water user associations (IWMI/SIC ICWC 2003) and an accompanying manual on social mobilization and institutional development (Ul Hassan and Nizamedinkhodjaeva 2003) for use in Central Asia. Unlike the IWMI/FAO guidelines, which are globally applicable, these publications were prepared to address specific IMT reform issues faced within the Central Asian context.

Study Objectives and Methodology

The objective of IWMI's research on IMT was to improve the global knowledge base on IMT experiences and impacts. Given the results of IWMI's studies and the fact that IMT was continuing despite its mixed track record, IWMI commenced a complementary set of projects to capitalize on the lessons learned from the past to improve IMT reform processes in the future. Through this latter set of projects IWMI developed decision support tools, guidelines, and, in some cases, became involved in on-the-ground implementation. As noted above, IWMI's role was

not to advocate irrigation turnover, but to objectively assess the results of past IMT experiences for the benefit of future decision-making and action. Thus, the focus of this study is to measure, to the extent possible, the outcomes of IWMI research on the overall IMT knowledge base and on IMT policy and operations in specific countries where IWMI played a direct role in shaping or implementing IMT reform.

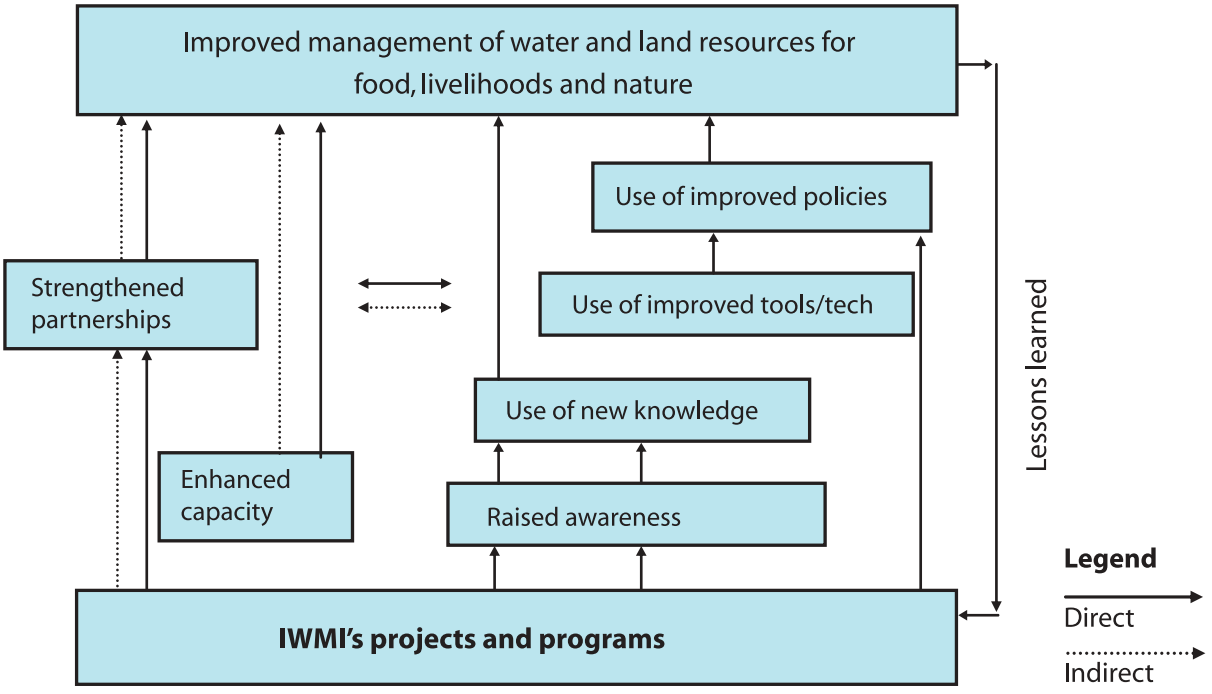
To carry out this assessment, we have organized our analysis around three hypothesized areas of influence from IWMI-IMT related activities, namely:

- Raised awareness of new research,
- Employment of improved policies, and
- Employment of improved techniques.

These three outcomes are drawn from a larger typology developed by IWMI to assist its researchers and management in tracking and measuring research outcomes and impacts (Annex 2). The typology, schematically represented in figure 1, focuses on seven broad outcomes that IWMI, together with its partners, can reasonably anticipate, track and measure. A set of vehicles for achieving impact as well as a set of sample indicators and measurement techniques are included in the typology. The typology thus serves as a planning and monitoring tool to assess progress along the impact pathway from project outputs towards the achievement of the Institute's overarching mission of improved management of land and water resources for food, livelihoods and nature. The typology, and figure 1, also distinguish between direct and indirect pathways. While with the former, IWMI research outputs raise awareness about new knowledge and offer policymakers and resource managers better tools to improve their decision-making; the latter enables IWMI's stakeholders to draw on partnerships, networks and strengthened capacity, which in turn may foster broader application of IWMI's research results.

Before describing the specific methodological framework applied in this paper, we must first emphasize the reasons for focusing on research outcomes rather than

FIGURE 1.
Outcome pathways.



impacts, i.e., not conducting a cost-benefit analysis with a rate of return on IWMI's research investment. First, for research activities in general there are long and variable time lags between the actual research project and a measurable change in related policies and practices (Alston et al. 1995; Smith 1998). While IWMI's research on IMT began in the early 1990s, most of the key recommendations and interventions date back just five to seven years. Second, establishing the attribution between IWMI's research and the adoption of their findings by policymakers is difficult (Ryan 2004). Third, an assessment of the economic benefits is limited by the lack of baseline data and resources available to collect them. As discussed in the conclusions below, IWMI is now addressing this latter issue for its research portfolio in general; and, for the past IMT projects in particular, a larger, formal impact study in the future may allow us to overcome this challenge.

Even in advance of a formal cost-benefit analysis, it is nonetheless useful to hypothesize the counterfactual situation for IWMI's IMT research program as a whole. As noted above, prior to IWMI's involvement, no comprehensive study had been conducted to document the past successes and failures of IMT reform. We posit then that by offering an impartial analysis of past IMT successes and failures at a relatively early stage, followed by informed recommendations and decision support tools, IWMI helped to reduce the transaction costs associated with IMT planning and implementation and increased the likelihood of longer-term success of IMT reforms. While we are unable to prove this assertion, the outcome analysis below provides some insights on the influences of IWMI's research on IMT to date. In the future, once sufficient time has passed since IWMI's interventions, we hope a more in-depth impact assessment could be conducted to formally test this hypothesis.

The methodology employed for this study draws on the general IWMI outcome assessment framework described above and utilizes a host of quantitative and qualitative measurement techniques to assess the influence of IWMI's research on IMT knowledge, policies and actions to date. The study begins with an internal review of the knowledge generated by IWMI on IMT through research publications, workshop proceedings and paper presentations. We then attempt to measure the demand for, use and estimated implications of IWMI's research on IMT at various scales and by various users. Proxy indicators, such as bibliometric and website download (webmetric) analyses, are used to measure the demand for IWMI's research products on IMT. More direct indicators, such as feedback from structured questionnaire surveys are used where IWMI's involvement was more explicit through action research or actual project implementation. We summarize in table 2 the techniques employed for each of the three outcome types tested. Specific details of each step in the methodology and the resultant outcomes are provided in the next section.

Results and Discussion

For each of the three outcome types, we describe below the results of our assessment of IWMI contributions to IMT knowledge and application through the projects and related outputs summarized above. For **raised awareness**, we utilize proxy indicators to broadly estimate the demand for and use of IWMI's research products on IMT. For the other two categories—**employment of improved policies** and **employment of improved techniques**—we limited our assessment to those regions/countries where IWMI played a relatively large role in IMT policy reform and implementation.

Raised Awareness of New Research

As described above, IWMI has developed a large body of literature on irrigation management transfer. The literature ranges from initial

TABLE 2.
Summary of techniques employed to test each of the three outcome types.

Outcome type	Target audience	IWMI vehicle to achieve impact	Measurement tool employed
Raised awareness of new IMT research	Academics, Policymakers	• IWMI IMT publications • IWMI presentations/ workshops on IMT	• Bibliometric/webmetric assessments
Employment of improved IMT policies	Policymakers	• IWMI IMT publications (indirect) • IWMI action research projects (direct)	• Internal and external source documents • Qualitative feedback • Demand for IWMI assistance on IMT from international organizations and national governments • Feedback via structured survey
Employment of improved IMT techniques/institutions	Canal irrigators, WUAs, Local NRM groups	• Pilot studies to establish WUAs • SCOR project implementation • Development of IMT and WUA guidelines	• Adoption of IWMI recommendations through WUA pilot studies • Adoption of SCOR interventions • Feedback via structured survey • Webmetrics and other feedback on IMT/WUA guidelines • Demand for IWMI assistance

assessments of IMT as a method to improve the management of agricultural water resources (e.g., Vermillion 1997), to gender analysis (e.g., Van Koppen 2002) and the impact of IMT on poverty (e.g., Van Koppen et al. 2002), to evaluations and assessments of past IMT experiences and from that related implementation and policy recommendations (e.g., Kloezen et al. 1997; Svendsen and Nott 1997; Vermillion and Garcés-Restrepo 1998, Vermillion et al. 2000). To assess the extent to which IWMI's literature on IMT resulted in raised awareness within the scientific community, we conducted a bibliometric assessment using Google Scholar™ (Beta) (http://scholar.google.com/) as well as an analysis of website downloads of IWMI's research products on IMT. Google Scholar covers a wide variety of publications, from peer-reviewed journal articles to technical reports and other non-peer reviewed publications. As a relatively new search engine, gaps still remain in the availability of articles on Google Scholar. However, as of July 2005, 50 percent of IWMI's 251 IMT outputs were registered on the site. For these 126 outputs, the Google Scholar search documented 529 total citations, of which 65 percent were from non-IWMI authors (table 3). The largest number of citations was of IWMI's Research Report series and peer reviewed journal articles. The single most cited publication was IWMI's IMT synthesis report (Vermillion 1997), which received 25 citations from non-IWMI authors.

An assessment of downloads from the IWMI website indicated potentially even broader demand for IWMI's research on IMT. For this analysis, we first reviewed raw statistics of website downloads[4] from the IWMI internet site for the period January 2000 to July 2005 (the period for which web statistics are available from the CGNET[5]). During this period, 18 IIMI/IWMI Research Reports and 5 IWMI Working Papers on IMT, dating from 1996 to 2003, ranked within the top 50 monthly downloads from the IWMI website, with over 29,000 total downloads of these 23 publications during the period.

A more detailed analysis of website downloads was conducted for the period October to December 2003. For this time period the

[4] Publications on IWMI's website are stored as Adobe™ Portable Document Format (PDF) files. The number of downloads indicates the number of times the file was successfully copied by a user. If an error occurred during the transfer, that transfer is not counted.

[5] CGIAR Network Services International (CGNET), a privately held company that provides internet, email and other web services to the CG Centers and others.

TABLE 3.
Summary of Google Scholar citations of IWMI IMT publications.

	IWMI's research products on IMT			Citations		
Publication category	Total	Registered in Google	Percentage registered (%)	Total	By non-IWMI authors	Percentage non-IWMI authors (%)
IWMI research reports	21	19	91	141	107	76
Journal articles (peer reviewed)	24	22	92	114	81	71
Workshop papers and proceedings	79	29	37	88	49	56
IWMI short report series	15	15	100	50	24	48
Other IWMI research/policy brief series	69	23	33	59	30	51
Books and book chapters	16	9	38	36	22	61
Monographs, technical reports, case studies	12	7	58	36	29	81
IWMI project reports and unpublished reports	12	2	16	5	3	60
Journal articles (non-peer reviewed)	3	0	0	0	0	0
Total	251	126	50	529	345	65

CGNET was able to provide ISP addresses, country and city information of IWMI's web users. During this 3 month period, over 1100 downloads[6] of IWMI Research Reports (853) and Working Papers (283) on IMT were recorded from institutions and individuals in developed countries (70%) and developing countries/ countries in transition (30%). Although most of the ISP addresses were generic (e.g., commercial search engines or state telecom lines), we were able to document over 170 downloads from universities and research organizations, approximately one-third of which were from developing countries/countries in transition.

While there are a number of caveats associated with webmetrics, it can serve as an indication of current and potential "usage impact" (Brody et al. 2006). In fact, recent research suggests a correlation between downloads of academic articles and subsequent citations. For example, Brody et al. (2006) in an analysis of physics and mathematics literature, found a significant correlation (0.4) between citations and article downloads. A positive correlation between citations and downloads was also found in two studies of papers published in the British Medical Journal (Perneger 2004) and in the Journal of Finance (Pinkowitz 2002). A further benefit of webmetrics is that it can capture (albeit imperfectly) other forms of usage apart from publications, e.g., use by practitioners (Pinkowitz 2002; Brody et al. 2006). While more research is clearly required to determine if these findings can be translated to the field of Natural Resources Management (NRM), webmetrics coupled with feedback from the actual downloaders themselves may serve as useful early indicators of NRM research impact.

Employment of Improved Policies

To test the influence of IWMI's research on IMT the employment of improved policies in Sri Lanka and Nepal,[7] we utilized both direct and indirect

[6] All downloads from IWMI are excluded from this figure.

[7] We focus here on IWMI's policy interventions in Sri Lanka and Nepal only as it is too early to assess the outcomes of IWMI's more recent IMT policy projects in Cambodia and South Africa.

measurement techniques. In Sri Lanka, we examined the outcomes of the IMPSA project implemented in the early 1990s. According to IWMI sources, following the IMPSA project, the government amended the Agrarian Services Act to provide legal recognition to farmer organizations. The government also amended the Irrigation Ordinance to legalize the role of farmer organizations in all major government owned irrigation schemes. Further, IWMI project documentation and later follow-up studies indicate that specific policy reforms proposed by the IMPSA project have been gradually applied over the past decade. For instance, the IMPSA recommendation to restructure the Mahaweli Authority of Sri Lanka, which manages the country's largest multi-purpose water resources development project, is currently being implemented. More importantly, in 2000 the government took action to implement a major IMPSA recommendation to establish a National Water Resources Council to formulate "a comprehensive water policy that looks at water in a holistic way, to put water to the most beneficial use at the least cost, so as to conserve it without degrading the environment and sustaining it for future generations as well" (IIMI 1992; Nanayakkara 2003).

IWMI's other major policy-level intervention was in Nepal, where the institute assisted with the country's IMT reform program. Since IWMI's involvement in the mid-1990s, many of IWMI's recommendations have been incorporated into Nepal's new Irrigation Regulation 2056. Specific references to IWMI recommendations within the Regulation include:

- Government support for building capacity of WUAs (Clause 5, Section 2).
- Promotion of record keeping by WUAs (Clause 5 and 6).
- Government assistance in regulating water quality control, environmental protection and security of water rights (Clause 5, 12, 16, 21, 24, 39, 40, 43, and 45).
- Retention of significant resource contributions to invest in Operation and Maintenance (O&M) (Clause 9).
- Provisions for forming joint committees (WUA and government agency) to fix irrigation service fees in irrigation systems (Clause 26).
- Establishing user fees that take into account O&M costs (Clause 28).
- Applying variable rather than constant flat rate fee systems (Clause 28) (IWMI 2000).

Additionally, on the basis of IWMI's and others' research findings related to gender and irrigation management transfer, Nepal's national irrigation policy now officially supports the role of women farmers in water management by stipulating that female farmers constitute at least one-third of WUA membership (IWMI 2000).

Employment of Improved Techniques

To assess the adoption of IWMI supported IMT techniques by canal irrigators, water user associations, and community resource organizations, we examined the outcomes of IWMI-led action research projects in Pakistan, Sri Lanka and Indonesia. We also reviewed the demand for and use of global and regional IMT guidelines to which IWMI has contributed. Measurement tools for this outcome category included qualitative feedback, structured questionnaire surveys and webmetrics.

Outcomes from IWMI WUA Pilot Studies in Pakistan

For the Pakistan study, we examined the progression of water user associations in two provinces following IWMI's pilot interventions. According to IWMI researchers in Pakistan, the provincial government has adopted the IWMI model in the three study canals since IWMI's pilot Farmer Organization programs in Sindh.

Furthermore, the lessons from the pilot study have helped in the formation of IMT policy elsewhere in the province (Jehangir pers. comm. 2004; Memon pers. comm. 2005). Developments in this area are now continuing as part of a larger IMT reform process in the entire Sindh irrigation system that began in late 1995 with the support of the World Bank. As part of this, the Sindh Assembly approved an Act, shifting the responsibilities for the management of the irrigation and drainage infrastructure, from the centralized Provincial Irrigation and Power Department to the Sindh Irrigation and Drainage Authority (SIDA), Area Water Boards, and Farmer Organizations (FOs). To carry forward the reform process, the Sindh government has set a goal of establishing over 1300 Farmer Organizations in 14 canal systems. As of April 2004, SIDA had registered 196 FOs, and management responsibilities had been transferred for 154 of these. As these Farmer Organizations are established, IWMI has been asked to assist SIDA in related capacity building activities (Jehangir pers. comm. 2004).

In the case of Punjab, following IWMI's intervention and the actual transfer of irrigation management responsibilities in May 2000, the Punjab Irrigation and Drainage Authority (PIDA) announced the Pilot Area Water Board in Lower Chenab Canal East. As a result, work is now in progress to transfer irrigation management responsibilities to 22 FOs. As in Sindh, IWMI has again been approached to assist PIDA in the capacity building of these FOs (Jehangir pers. comm. 2004). While we cannot directly attribute the developments in Sindh and Punjab to IWMI interventions, the direction of change is consistent with IWMI recommendations. Further, the fact that IWMI is again being asked to assist in future IMT activities is a strong indication of the use of IWMI's research findings by policymakers.

Outcomes of SCOR institutional interventions

While not a specific IMT project *per se*, the SCOR project was a complementary research effort that drew on IWMI's knowledge products on IMT. Through its IMT research, IWMI focused extensively on collective action by farmers for irrigation management. A key institutional innovation under the SCOR project was to extend that concept to community/user participation in other areas of natural resources management. The specific institutional interventions promoted in the SCOR project were:

- Strengthening the capacity of resource groups to participate in natural resources management,
- Improving tenure arrangements for land and other resources to achieve both increased production while conserving the natural resource base,
- Strengthening the capacities of government agencies, NGOs and private sector organizations in natural resources management, and
- Improving the coordination and linkages between state agencies, NGOs, and other stakeholders involved in the management of natural resources.

To test the outcomes of the SCOR institutional interventions, we utilized key informant interviews, focus group discussions, informal interviews with farmers, and a structured questionnaire survey involving 187 farmers. In contrast with the Pakistan pilot project, the SCOR institutional interventions, which as in Pakistan were aimed to promote greater local control over natural resources management, appear to have been much less successful following the conclusion of project activities. Based on the comments received from the interviewees, with the exception of a few sites, the sustainability of the SCOR institutional interventions were negligible. For example, while two-thirds of the survey respondents are currently members of resource user groups, only 4 percent are members of the resource user groups established by the SCOR project. The reasons given are manifold but related more to implementation deficiencies than to a lack of intrinsic worth of the institutions themselves. Many of the interviewed SCOR

farmers claimed for instance that they did not have the right understanding of the objectives of the project from the very beginning, and considered the project more of a short-term aid operation than a longer-term participatory research and extension project. A second reason given for the lack of continuity of the SCOR created institutions was the drastic change in the administration of farmer organizations following the change in government in 2001. Finally, several farmers explained that the longer-term goals (and potential benefits) of the SCOR project were difficult to balance with short-term household subsistence needs.

The study found that the villages that have continued to implement the SCOR institutional innovations are largely characterized by severe water shortages and, perhaps as a result, tend to have strong leaders of the local farmer organizations. Benefits in terms of farmer credit and other institutional gains appear to have continued for these villages. However, it must be noted that in these villages the organizations are not performing according to the originally planned or stated functions of SCOR.

One notable success recorded in the interviews relates to the role of the Resource User Organizations in one of the project study watersheds. Prior to the SCOR project, the farmers in this region had no legal right to use the water from Mahaweli system. The results of the field survey, however, suggest that following the establishment of the SCOR sponsored Resource User Organizations, the farmers were able to lobby and become the legal users of the Mahaweli irrigation system. As a result, the survey respondents indicated that the cropping pattern and intensity have changed, the cultivated area has increased, and the demand for shifting cultivation has significantly declined. Hence, this may be a case where the knowledge generated by IWMI's research on IMT has indirectly led to improved water productivity and a more equitable access to resources. However no quantification or economic valuation of these effects could be carried out in the context of this study.

Results from IWMI IMT Interventions in Indonesia

As noted above, IWMI's involvement in Indonesia at the operational level was largely limited to monitoring and evaluating the transfer process. IWMI was specifically involved in four pilot projects in two provinces through a technical assistance program funded by the Asian Development Bank. To assess the outcomes from IWMI's interventions, we circulated a structured questionnaire survey to 10 government agencies, research organizations and water user associations involved in the pilot projects. Of the 8 respondents, 5 indicated that the recommendations made by IWMI during the pilot studies had influenced the subsequent implementation of IMT policy in Indonesia. Specifically, the respondents highlighted the influence of IWMI recommendations concerning the involvement of farmers in IMT planning and implementation, the need for continued agency support for WUAs and Farmer Organizations following irrigation turnover, and the importance of supporting legal frameworks to strengthen and empower WUAs.

Employment of IWMI WUA Guidelines

A final test of IWMI influence at the operational level involved an assessment of the demand for and use of IWMI authored guidelines on IMT and the establishment of WUAs. We focused this analysis on the IWMI/FAO IMT guidelines (Vermillion and Sagardoy 1999) and the two reference documents on the establishment of water user associations in Central Asia (IWMI/SIC ICWC 2003; Ul Hassan and Nizamedinkhodjaeva 2003). To gauge the influence of these guidelines we utilized FAO publication statistics, web downloads of the Central Asia guidelines and circulated a structured questionnaire survey on the use of both the FAO/IWMI and WUA guidelines for Central Asia.

According to FAO statistics, a total of 5700 copies of the IWMI/FAO guidelines have been produced and distributed since 1999. This includes 4100 in English with an additional 1600 in Spanish, French and Russian (Munoz pers. comm. 2005). Further information on the use of these guidelines is provided below.

In contrast with the IWMI/FAO guidelines, IWMI's guidelines on the establishment of water user associations in Central Asia were disseminated primarily through the IWMI website. The results of our website analysis indicate that since the release of the guidelines in March 2004, they have consistently ranked in the top ten downloads each month, with downloads of the English language version averaging around 475/ month.[8] We understand that the popularity of the English language version, when compared with the local language translations, stems from the fact that many international NGOs are now utilizing the guidelines with their local partners. For example, the IWMI-Central Asia office has been contacted by several NGOs and other development agencies including ACTED, Mercy Corps and GTZ, who have confirmed their application of the guidelines in Tajikistan, Uzbekistan and Azerbaijan (Ul Hassan pers. comm. 2004). ACTED in particular noted their appreciation of the ease with which the guidelines can be understood and applied and the utility of local language translations (Gulomjanov pers. comm. 2005). In addition, the Asian Development Bank has drawn from IWMI's WUA guidelines to prepare WUA training manuals and has further recommended IWMI guidelines to the Agha Khan Foundation's Microfinance and Social Development Support Project and to CARE in Tajikistan (Shafique pers. comm. 2005). A recent external review of the project also highlighted the Social Mobilization and Institutional Development guidelines as one of the major achievements of the project "for establishing WUAs and CWCs (Canal Water Committees), for conflict resolution, and for addressing legal issues" (PA Government Services 2005, v).

As both sets of guidelines are practical in nature, we also circulated a structured questionnaire survey to government agencies, universities and NGOs in eight countries[9] in South, Central, and Southeast Asia where IWMI has undertaken IMT research activities to assess the awareness and application of the IMT and Water User Association guidelines. Specifically, the questionnaire recipients were asked about their awareness of IWMI's guidelines and whether they had used the guidelines for implementing IMT programs in their respective countries. A total of 44 questionnaires were distributed among 26 respondents from seven countries. Half of the respondents were aware of the IWMI/ FAO IMT guidelines and nearly all respondents in Central Asia were aware of the Water User Association and Social Mobilization and Institutional Development guidelines.

The survey results indicated that the guidelines were particularly popular in Central Asia where IMT is a more recent policy intervention to help transition from state-dominated to more participatory forms of irrigation management. Out of these seven respondents, all but one had utilized one or more of the guidelines for training, operational, and/or reference purposes. Further, the respondents indicated that they had used the guidelines to establish over 250 water user associations themselves and had recommended the guidelines to nearly 55 other institutions, basin authorities, and individuals. The specific benefits of the guidelines as noted by the respondents from Central Asia and elsewhere include:

- Improved understanding of institutional reform and farmer participation in irrigation management (66.7%),
- Improved project design and management (50%),

[8] The WUA guidelines have also been translated into Russian, Tajik, Uzbek, and Kyrgyz.

[9] The eight countries include Sri Lanka, India, Nepal, Pakistan, Indonesia, Uzbekistan, Tajikistan and the Philippines.

- Improved quality of work (50%),
- Facilitation of the establishment of effective WUAs (33.3%),
- Enhancement of the effectiveness of the project implementation (33.3%), and
- Reduction of operational cost (16.7%).

Although the results draw from a small sample size, this feedback suggests that the use of and benefits from the guidelines have not been insignificant.

Conclusion and the Lessons from IWMI's Research on IMT

During the last two decades many governments have taken steps to transfer irrigation management responsibility to farmer or other local organizations. This action has been based on the premise that involving farmers in irrigation management decisions will improve the accountability of the irrigation service to farmers, result in more effective service provision, motivate farmers to invest more in maintaining irrigation systems and, ultimately, make irrigation systems and irrigated agriculture more sustainable. Since the early 1990s, IWMI has tried to inform this process by documenting past experiences and impacts of IMT in a number of countries throughout the world, and, based on the results of this research, by offering guidelines, policy advice and technical support for future IMT decision-making and application.

In this paper, we have described both the background of IWMI's research on IMT and related interventions and have attempted to assess the outcomes from these contributions. The analysis did not focus on the overall success of IMT, as that was indeed the objective of the first phase of IWMI's IMT research program. Instead, the paper concentrated on IWMI's influence on the global IMT knowledge base as well as on IMT policy and operational decisions. More specifically, the analysis focused on three hypothesized outcomes of IWMI's research on IMT, namely, raised awareness, improved policies, and improved techniques. The methodology applied in this study drew from a broader conceptual framework and typology developed by IWMI for NRM outcome assessment and utilized a range of direct and indirect measurement tools.

While we did not apply a traditional cost-benefit analysis to quantify IWMI's impact for the reasons noted above, the application of a range of direct and indirect measurement techniques suggest an overall positive contribution from IWMI to IMT theory and application. The results of the bibliometric and webmetric analyses suggest a large and continuing demand for IWMI research products on IMT. Direct and indirect data sources also indicate that IWMI policy and operational level interventions have in general contributed positively to IMT decision-making and action both nationally, through action research projects, as well as regionally and globally, through the development of generic IMT guidelines. Finally, continued demand for IWMI involvement in IMT action research serves as an important indicator of IWMI's past contributions. Requests for IMT and participatory irrigation management research and training activities of IWMI were already noted above with regard to Cambodia and Pakistan. In addition, the state governments of Andhra Pradesh and Maharashtra in India recently requested IWMI to help address certain second generation problems associated with IMT. IWMI, at the request of the national government, is providing policy-level support in South Africa as well as the country reforms its water laws and institutions.

Finally, in addition to analyzing the contributions of IWMI's research on IMT, this study has also highlighted important programmatic and operational lessons. Programmatically, the results of the SCOR outcome assessment suggested a need for IWMI to better clarify its position vis-à-vis its partners on the research-development continuum. While the assessment of SCOR's technical interventions yielded somewhat more positive results, the overall performance of the SCOR project was substantially lower than the standards IWMI set out to achieve. The interviews carried out as part of the outcome assessment suggested that some of the reasons behind the poor uptake of the SCOR interventions included a need for stronger capacity building for the newly created institutions and a clearer understanding of the overall goals and objectives of the project. As mentioned above, IWMI played a somewhat unusual role in this particular project, focusing more on knowledge application than its traditional knowledge generation function. Since the SCOR project and as part of the IWMI Strategic Plan 2004-2008, IWMI has endeavored to more clearly define the roles for itself and the complementary roles of NGOs and other development organizations with whom it partners. Specifically, the 2004-2008 Strategic Plan outlines and sets out a plan for the institute to develop stronger relationships with appropriate development partners (NARES, local NGOs, International NGOs) who can draw from the knowledge generated by IWMI and its partners and better enable its application.

Operationally, the study offers important insights for future outcome and impact studies. One key lesson is that proper ex-post evaluation requires careful planning and monitoring before, during and after the project lifecycle. The difficulties encountered in this study in accessing baseline information have thus reinforced IWMI's decision to promote more informed outcome and impact planning and monitoring as part of its project management system. Second, this study has attempted to demonstrate the value of outcome analysis as an intermediary step towards impact assessment. As noted above, there are inherently long and variable time lags between research and broader uptake. Tracking project outcomes through a variety of qualitative and quantitative means, however, allows research organizations to assess at a much earlier stage the general direction of project influence, which in turn can be used to inform future programmatic decision-making long before adoption studies are possible. This paper has demonstrated several techniques that may be applied in future outcome studies, and has suggested additional tools worth further examination including webmetrics and internet surveys. While formal impact assessments may not be feasible for each and every project, some level of outcome analysis in every project supplemented by a representative sample of impact assessments will allow research institutes, such as IWMI, to more effectively monitor the influence of its past projects and programs and from that more effectively design future projects and programs for the benefit of its stakeholders.

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Annex 1.

Summary of IIMI/IWMI's research on IMT impacts.

No.	Study country	Study methodology	Impact indicators	Outcomes/conclusions	Citation
1	Global (Egypt, Philippines, Turkey, New Zealand, Colombia, Chile, China, Mexico, Dominican Republic, Bangladesh, Indonesia, India, Sri Lanka, Nigeria, Nepal, Pakistan, Vietnam, Sudan, USA, Senegal)	• With-and-without comparisons • Before-and-after comparisons • Review of literature	• Financial performance (cost to government, cost to farmers, management staff, fee collection rates, budget solvency, diversity of revenue sources) • Quality of operations and maintenance • Agricultural and economic productivity • Environmental sustainability	• Except in a few cases, there was a general improvement in financial performance. • Water distribution efficiency and equity (operations) have shown improvement except in a few cases in Bangladesh and the Philippines. • Results regarding the state of improvements in maintenance are mixed. • Agricultural productivity (cropping intensity, crop yields and cropping patterns) have shown improvement except in the Sudan and a few other cases of mixed results. • Results regarding profitability are mixed. • There are a few cases reporting the environmental impacts of IMT, the results in this regard are also mixed. • In Chile, WUA put pressure on paper companies to internalize the cost of pollution. • In Colombia, farmers were organized to prevent deforestation in the catchment areas. • In the Dominican Republic, farmers have reversed land degradation and soil loss and significantly reduced health risks previously associated with water logging from poor drainage. • In Senegal, IMT has increased water logging and salinization.	Vermillion 1997
2	Colombia	• Before-and-after comparison • Elicitation of stakeholders' perspectives	• Cost of irrigation to farmers and the government • Sustainability of irrigation (financial viability and physical conditions of irrigation infrastructure) • Quality of water distribution (efficiency and equity of water distribution, and productivity of water)	• Reduced government expenditures. • Variable effects on the cost of irrigation to farmers. • No change in the quality of financial management. • Greater water use inefficiencies. • Decline in irrigation intensity and poor water management. • No clear or significant changes in the quality of irrigation operations. • Most of the schemes transferred appear to be physically sustainable. • No clear productivity impacts. • Discontinuance of government subsidy. • Partially successful in containing cost of management and balancing budget. • Actual cost of irrigation to farmers rose slightly. • Large majority of structures are fully functional or in good physical condition. • Low total conveyance efficiency and reduced delivery performance ratio (poor equity of water distribution). • Gradual expansion of irrigated area. • No noticeable detrimental impact on yields.	Vermillion and Garcés-Restrepo 1996; Vermillion and Garcés-Restrepo 1998

(Continued)

Annex 1. (Continued)

Summary of IIMI/IWMI's research on IMT impacts.

No.	Study country	Study methodology	Impact indicators	Outcomes/conclusions	Citation
3	Mexico	• Before-and-after comparison • Elicitation of farmers' perceptions	• Efficiency of water allocation and distribution (relative water supply) • Volume of water pumped from the aquifers • Comparison between annual recharge levels of aquifers and total volume pumped (level of exploitation of the aquifers) • System maintenance • Financial performance • Agricultural and economic productivity	• There was no discernible differences between pre- and post-transfer in relative water supply. • All farmers receive sufficient water to meet crop requirements. • Bribery has decreased. • The attitude of agency staff towards irrigators has improved. • Over-exploitation of the aquifer or alarming high level of excessive use of groundwater use. • The level of maintenance investment has remained the same, but the quality of maintenance services has increased. • The number of staff responsible for maintenance has decreased. • Actual quantities of maintenance work has increased. • The process of paying irrigation fee has become less cumbersome. • Bribing has been reduced: Irrigation fee per hectare per season as percentage of gross value of product dropped. • Fee collection rate has dramatically increased: real O&M expenditures have increased. • The observed yield increases cannot be attributed to IMT alone and the changes in productivity values of land and water cannot be readily attributed to IMT.	Kloezen et al. 1997
4	Indonesia	• Before-and-after comparison • With-and-without turnover comparison • Elicitation of farmers' perceptions	• Management efficiency, organizational viability and support systems • Operational performance (water distribution, irrigation intensity) • Maintenance performance • Agricultural productivity (crop yields, economic returns, cost of irrigation to farmers)	• Modest improvements in management efficiency and responsiveness. • No increase in cost of irrigation to farmers: water distribution system either improved or remained positive. • Under-investment in maintenance by farmers. • No significant changes in agricultural performance or in economic returns per unit of land and water.	Vermillion et al. 2000
5	Niger	• Comparison of inter-scheme performance differentials	• Outputs and output values • Level of use and productivity of water • Costs • Fee collection and operating finances • Institutional strength	• Good performance in yield, land utilization and gross output. Weak financial management and organizational skills. • Lack of support from the organizations' members: Organizations lack transparency and accountability. • All the co-operatives have struggled financially.	Abernethy et al. 2000

(Continued)

Annex 1. (Continued)

Summary of IIMI/IWMI's research on IMT impacts.

No.	Study country	Study methodology	Impact indicators	Outcomes/conclusions	Citation
6	India	• Assess the differential impact of IMT on poor and non-poor farmers • Elicitation of stakeholders' perceptions (trade-off analysis) • With-and-without comparisons	• Poverty and farm size relationships (plot location, crop choice, income sources) • Access to water by farm size category (irrigation sources, differential access to water) • Efficiency of water distribution (irrigation intensity, flexibility of water supply) • Maintenance performance • Agricultural productivity (crop yields, cropping intensity, cropping pattern changes) • Government financial performance (staffing changes, maintenance expenditure, fee collection) • WUA financial performance (changes in operations and maintenance cost, recovery rates) • Sustainability of physical systems	• Small farmers are mainly concentrated in the tail ends and have low canal water accessibility (Andra Pradesh). • No differences exist between small and large farms in water accessibility in Gujarat. • Low farmer participation in WUA and most small farmers are unaware of WUAs. • Small farmers often participate in repair and rehabilitation. • Large farmers in meetings and committees. • Inequitable distribution of benefits. • Improved water distribution. • Mixed results regarding yield impacts. • No impact on government finances is yet visible. However, there was potential for positive effects on government finances. • Improved maintenance performance. • Improvements in water distribution. • Mixed results regarding agricultural productivity. • IMT has increased cultivated area, shift to higher value crops and obtained higher yields. • The cash cost of irrigation to farmers has increased. • Increased availability of water. • Improved reliability of supply, flexibility in cropping pattern. • Considerable savings in time to obtain water and reductions in hassles to pay for water. • A more equitable water distribution and hence a reduction in conflicts.	Van Koppen et al. 2002; Naik et al. 2002; Brewer et al. 1999

Annex 2.

IWMI outcome typology.

Ultimately, IWMI hopes that its projects and programs will have a lasting and global impact on water and land management for the benefit of food production, livelihoods and nature. Beyond the conceptual level, however, it is unrealistic to expect that impacts at this level could be easily measured or attributed. Thus, while maintaining a vision towards the broader spatial and temporal impacts of our projects and programs, we have designed a typology outlining the key outcomes that the Institute, together with its partners, can reasonably anticipate, track and measure.

Expected outcomes of IWMI's research agenda	Vehicle to achieve impact	Sample indicators	Sample measurement tools
Raised Awareness of New Research	• Scientific publications of IWMI research • Publications in popular press, brochures, videos, posters • Public availability of datasets • Public availability of literature reviews • Synthesis of IWMI and non-IWMI research • IWMI participation in conferences/committees/forums • Advising of MSc/PhD students	• Number of citations of IWMI publications • Number of downloads/requests • Number of requests for IWMI staff to actively participate in workshops, conferences, committees, forums • Number of students supervised through IWMI research	• Bibliometric assessments • Website statistics • IWMI official project records • IWMI capacity building program records
Application of New Knowledge	• Scientific publications of IWMI's research (including methodologies and approaches) • Collaboration with NARES/NGOs	• Number of citations of IWMI publications • Number of requests for information/data • Evidence of application of research by int'l/national research, development, and extension systems (e.g., number of NARES reports drawing from IWMI research) • Incorporation into curricula	• Bibliometric assessments • IWMI official project records • Interviews • Questionnaires • Observations
Employment of Improved Tools, Technologies, Techniques	• Development and dissemination of new, user-friendly decision support systems, maps, models • Development and/or dissemination of technical interventions/practices • Related demonstrations/training	• Number of downloads/registration of and/or requests for IWMI tools • Evidence of integration of tools into national research programs • Evidence of usage by int'l/national research, development, and extension systems • Incorporation into curricula • Change in practice/behavior	• Website statistics • Interviews • Questionnaires • Observations

(Continued)

Annex 2. (Continued)

IWMI outcome typology.

Expected outcomes of IWMI's research agenda	Vehicle to achieve impact	Sample indicators	Sample measurement tools
Employment of Improved Policies/Institutions	• Policy briefings • IWMI participation in policy-related committees/forums • Policy roundtables • Advisory meetings with policymakers and resource managers • Promotion of formal/informal institutional frameworks	• Number of downloads (policy briefing materials) • Number of requests for information/advice • Requests for participation in panels/forums • Evidence that policy/institutional recommendations have been taken into consideration by relevant decision-making bodies (e.g., placed on policy agenda) • Adoption of policy/institutional advice • Creation and maintenance of institutions beyond project period • Change in practice/behavior	• Website statistics • Observations • Interviews • Policy dialogue monitoring
Enhanced Capacity	• Project involvement (field staff, NARES partners, IWMI staff) • NARES/NGO partnership program • Visiting scientist program • Training (in-house/external) • Training publications/videos • PhD scholarship program • Postdoc fellowship program • Internships • Policy roundtables	• Number of beneficiaries of IWMI's capacity building programs (by gender and nationality) • NARES partners play more active role in regional/int'l research and research networks • Personnel performance indicators (e.g., promotions) for both IWMI and partner staff • Theses completed • Postdoc publication record • Changed knowledge/perceptions/practices	• IWMI official project documents • Human resources data • IWMI capacity building program records • Pre/post project/training evaluations • Questionnaire
Strengthened Partnerships	• Collaborative projects • Collaborative publications • NARES/NGO network development • National consultative meetings • Participation in editorial boards, steering committees, global/regional programs	• Number of co-authored outputs • Frequency of collaboration • Level of shared financial commitment between IWMI and its partners • Number of consultative meetings • Number of national/regional/global networks	• Bibliometric assessment • IWMI official project documents • Questionnaire • Interviews
Improved Livelihoods (within project location)	• Direct intervention • Partnership with implementing agency (e.g., through NARES/NGO partnership program)	• Adoption rates (by gender and socio-economic status) • Changed perceptions/practices (by gender and socio-economic status) • Level of livelihood improvement, e.g., yields, income, health (by gender and socio-economic status)	• With/Without studies • Pre/post project evaluations • Interviews • Observations • Official statistics

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