DRAFT FINAL REPORT

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RESEARCH PROGRAM
IN
FARMER-MANAGED IRRIGATION SYSTEMS

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INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE
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EXECUTIVE SUMMARY

The International Fund for Agricultural Development (IFAD) and The German Federal Ministry for Development Cooperation (BMZ) made available to IIMI a 3-year grant to support research on farmer-managed irrigation systems (FMIS), beginning in January 1988. The aim of the FMIS Project is to help both governmental agencies and nongovernmental organizations (NGOs) at the national level to develop more appropriate and effective assistance strategies, and to develop assessment methods to enable managers and planners to reach informed decisions about intervention options. Through its FMIS research, IIMI seeks to strengthen national research capacity to respond to the changing needs of the farmer-managed sector. The specific objectives of the program are:

* to document management practices and evaluate management problems in farmer-managed systems;

* to evaluate and develop alternative intervention strategies;

* to develop case-study training materials that illustrate alternative approaches to assist FMIS for policymakers and planners; and

* to develop methodologies for diagnosing FMIS problems for use by the staff of implementing agencies and researchers.

To meet these objectives the FMIS project employed two research modes.

1. An Indirect Network Mode - This involves the FMIS Network which was initiated in 1987 as a means to organize and bring together researchers, practitioners, members of implementing agencies, and donors to exchange information and experiences and to stimulate research and innovative approaches in the field of FMIS. Currently, the FMIS Network links more than 1200 irrigation professionals from 76 countries, representing a wide variety of disciplines and professions and geographical regions. Network activities include a wide variety of topics and modes. It includes organizing and supporting study tours and workshops and providing some common methodologies for undertaking activities by agencies represented in the network. The FMIS Newsletter is the main link between the network members and is an important outlet for research results as well as a useful channel for sharing experiences.

2. Direct Research - This is conducted in collaboration with colleagues from national-level agencies and includes both long-term case studies and rapid appraisals. Six countries have been included in the study: Sri Lanka, Thailand, Bhutan, Pakistan, Bangladesh and Morocco. The greatest part of the work to date has been conducted in Sri Lanka. Research in Thailand, Bhutan and Morocco began in late 1988 and early 1989. In Pakistan research began only in 1990, and work will soon begin in Bangladesh. The Research has focused on documenting assistance strategies in various systems under rehabilitation, training, and strengthening the national research capacity.

This Report provides a comprehensive account of the first phase of IIMI's FMIS program including its direct research and networking activities, the results and impact of such activities, and the need for further expansion of this program in the future.

Phase I of the program has highlighted certain critical issues in farmer-managed irrigation. They are:

* There is a need to further increase awareness among government officials of the economic importance of the FMIS sector and to find ways to support its productivity and sustainability. The importance of FMIS is often not reflected in the funds allocated by the respective governments. Relatively small government investments in the FMIS sector can produce much higher positive returns than is the case for investment in agency-sponsored irrigation. This is largely because projects can be completed quickly, benefits are realized sooner, and farmers are more likely to provide corresponding local investment.

* Government assistance to FMIS should be provided only where water user rights, responsibilities, performance objectives and system boundaries are clear, or where they will be made clear under the assistance programs. Development of effective FMIS institutions depends on a proportional and direct relationship between farmer investment, and responsibilities and water user rights.

* Management problems and development needs differ considerably between FMIS in different types of "hydro-management" environments. Each environment needs special attention and different strategies for research and development. Groundwater and other lift irrigation systems are the fastest growing types of FMIS today and need greater investment in research and assistance due to their growing importance. A second category of fast growing FMIS is that of systems whose management is being turned over from government agencies to water users' associations. This is a very widespread phenomenon with its own particular challenges, given the pressures to create effective farmer management institutions in settings where the primary irrigation investment is not indigenous.

* Local investment by farmers in FMIS is a key factor in the institutional development of FMIS and consists not only of investment of farmer labor and equity, but also of investment in indigenous technical knowledge, organized efforts to negotiate decisions among fellow farmers and creating and implementing rules and sanctions. This is evidenced in a number of cases where the use of local knowledge and experience allowed for improved farmer operation and maintenance of the system with lower costs for improvements.

* There is a need to encourage local institutional development, agencies should give less attention to standardized institutional models and training modules and more attention to helping FMIS clarify their own management objectives and functional management requirements.

* In recent years, nongovernmental organizations have become increasingly involved in assisting FMIS, especially in the institutional development aspects. They have more flexibility in undertaking projects and appear to respond more to farming-community needs and less to political pressure. There have been numerous examples where such nongovernmental entities as social organizers and farmer-to-farmer exchange training strategies have proven so successful that they have shifted from being only pilot projects to parts of national programs.

* There is a strong need in many countries to develop effective programs and organizational arrangements for assisting their FMIS sectors. There tends to be a lack of well-developed laws and policies related to FMIS since the governments have not had substantial involvement in this sector.

* There is a need to analyze the various constraints which exist within bureaucracies for interacting with FMIS in ways which are sensitive to local needs and capacities. Rigid "quality control" or design standards impose emphasis on structures which may not be important to farmers.

Although the FMIS program has been operational only for a short period of three years, its activities have been vital and influential. The well-established and growing FMIS Network draws the attention to the potential and the importance of FMIS in various parts of the world. The expansion of the Network to Africa and Latin America during Phase I of the Program was a direct result of people from these two continents taking part in its activities and more attention was given to initiating FMIS programs in African countries like Egypt, Sudan, Morocco and Nigeria. In Latin America, the FMIS Network has already made significant progress in Argentina in creating awareness of the importance of FMIS among the various institutions in the country. The activities in Argentina have stimulated interest among the neighboring countries such as Chile, Brazil and in particular Peru, presenting new opportunities for the exchange of information and experiences with Latin American countries.

Several countries has realized the importance of farmers' experience and knowledge in the rehabilitation of FMIS and, as a result, they have changed their approach which had previously been mostly technically oriented. The experience gained in FMIS is having an impact on the preparation of new irrigation management policies. The involvement of government and agency officials in FMIS workshops and in other activities of the FMIS program has, in some cases, a direct effect on government strategies.

Most of the Network activities and the research program in Phase I were concentrated in Asian countries. These activities have proved that the FMIS Network provides an excellent framework for the mobilization of additional resources, particularly in relation to activities such as workshops, training, study tours and the publication of research topics and workshop proceedings. It is planned that in Phase II the program will emphasize the implementation of selected lessons learned in Phase I and the expansion the Network activities to include African and Latin American countries as well as additional countries in Asia.

1. FMIS PROGRAM ACTIVITIES

1.1 FMIS PROGRAM ACTIVITIES AND THEIR OUTCOME

The FMIS Program of the International Irrigation Management Institute (IIMI) has been funded by the International Fund for Agricultural Development (IFAD) and the German Federal Ministry for Development Cooperation (BMZ). This funding provides basic seed support for the FMIS program which allows IIMI to attract other donors and to use other funds to support the program and expand its activities. The other donors who have provided some funding for specific activities are: the United Nations Development Programme (UNDP), the Ford Foundation (FF), the International Development Research Centre (IDRC) and the Caisse Centrale de Cooperation Economique (CCCE).

1.1.1 OBJECTIVES:

The FMIS Research Program evolved naturally from the Kathmandu workshop on public intervention in FMIS. Its aim is to help both government agencies and nongovernment organizations to develop more appropriate and effective FMIS assistance strategies, and to develop assessment methods to enable managers and planners to understand when and how intervention can be successful. Through conducting FMIS research, IIMI attempts to strengthen national research planning and implementation capacity leading to more appropriate and effective policies regarding the farmer-managed sector. Specific program objectives are:

* to document management practices and evaluate management problems in farmer-managed systems;

* to evaluate and develop alternative intervention strategies;

* to develop case study training materials that illustrate alternative approaches to assist FMIS for policymakers and planners; and

* to develop methodologies for diagnosing FMIS problems for use by the staff of implementing agencies and researchers.

1.1.2 STRATEGY:

To meet these objectives the FMIS project employed two research modes, an indirect network mode and direct research. The indirect mode involves the FMIS Network which generates and disseminates information, and provides backstopping support to policymakers, managers, and researchers who are concerned with and/or are actively engaged in assisting the FMIS sector. At the same time, IIMI has carried out direct research in collaboration with national research institutes and/or implementing agencies. Section 2 gives a detailed description of the network activities (indirect mode) while Section 3 describes some of the important results of the direct research.

1.2 BACKGROUND

Irrigation systems fall into two broad categories: those in which the principal management responsibility is exercised by government or nongovernment agencies with the farmers playing a subsidiary role, and those in which most management activities are carried out and decisions made by the farmers themselves, with the government agencies providing (at most) periodic technical support. The latter category is identified as Farmer-Managed Irrigation Systems (FMIS). In general, an important characteristic of FMIS is that the farmers control and manage water abstraction at its source.

In most developing countries, FMIS cover large areas and a great number of beneficiaries, not only in relative terms but also in absolute terms. FMIS also cover a wide range of environments and technologies which include among others gravity systems, groundwater lift systems, surface lift systems, and oasis flood recession systems. In some countries a significant portion of the irrigation sector comprises FMIS. For example, in Bangladesh and Nepal it is 90 percent and 70 percent, respectively.

Governments often classify these systems as "small-scale irrigation systems" or "minor irrigation systems," although FMIS may be found in command areas of 15,000-20,000 hectares (ha). FMIS are also known as traditional, indigenous, communal or people's systems. Public irrigation development, which is often characterized by large-scale, capital-intensive interventions that are restricted to specific areas, often focuses attention away from FMIS. Groundwater development is also predominantly farmer-managed and is increasing in importance in countries such as India, Pakistan and Bangladesh.

Farmer-managed irrigation systems in many countries contribute to the production of a significant portion of the subsistence food supply. Moreover, FMIS are often found in areas affected by drought where they play a strategic role in promoting and ensuring food security. These systems have allowed intensification of agriculture to partially meet the needs of rapidly growing populations.

Some systems are hundreds of years old, well-managed, and very productive, while others are performing far below their potential. Many are in valleys far from roads and are not easily accessible. They represent valuable, accumulated investment and a reservoir of irrigation management experience from which many lessons can be learned. At the same time, they are a resource that faces many difficulties in that public financial support and technical services for these systems are in general not in proportion to the importance of FMIS.

Many FMIS, especially those that have been operating for long periods, have strong internal organizations. However, for a variety of reasons -- economic, social or environmental -- FMIS are also frequently faced with major difficulties in managing operation and maintenance (O&M). System managers are unable to overcome some of these problems on their own and require some external, appropriate resource assistance. For example, farmers in small hill systems often greatly benefit from timely assistance in redesigning and repairing their

temporary diversion structures and long conveyance channels. Those drawing water from small storage systems may need help with desiltation and catchment area rehabilitation as well as help with the efficient, equitable and sustainable development of groundwater resources.

The management decisions of private pump owners (whether operating individually or in groups) are dependent upon appropriate support from the government with regard to information concerning aquifer conditions, credit, energy, pricing, water supply, and adequate mechanical backup services. In this context, the role of the central government is mainly that of a "service agency." This is very different from the direct implementation role that governments may be more accustomed to playing in agency-managed systems, and it calls for very different approaches and skills, most important of which is the ability to interact and work in collaboration with the concerned village or irrigation scheme.

In indigenous FMIS, the physical system and management system have evolved as an integrated socio-technical process. However, sometimes the effort of many generations of farmers is still ignored and new construction is imposed upon existing FMIS. This disruption of existing institutions -- water rights, rules, roles, and the organization of beneficiary groups -- increases conflict and shifts the burden of O&M to the agency, which may result in lower agricultural production.

In the past decade, donors have given considerable support to FMIS, hoping thereby to improve system productivity and increase the livelihood of farmers. This help has more often been of a welfare nature, i.e., to more uniformly distribute national investments in irrigation among farmers, particularly among poorer farmers.

The 1986 Kathmandu Workshop on "Public Intervention in Farmer-Managed Irrigation Systems" served to crystalize this recognition of the importance of the FMIS in the irrigation sector. Among the outcomes of the conference was a future research agenda developed by participants to address four questions:

1. What are the forces leading to government intervention?

2. What are the factors leading to dependency?

3. What are the appropriate planning, design and operational management criteria for these systems?

4. What are the effects and implications of extended involvement of governments in Farmer-managed irrigation systems?

2. THE FMIS NETWORK

One of the outcomes of the workshop on "Public Intervention in Farmer-Managed Irrigation Systems" conducted in Nepal in August 1986 was to initiate the FMIS Network. The FMIS Network is a means to organize and bring together researchers, practitioners, members of implementing agencies, and donors to exchange information and experiences and to stimulate research and innovative approaches in the field of FMIS.

Currently, the network links more than 1200 irrigation professionals from 76 countries, representing a wide variety of disciplines and professions and geographical regions. Countries with more than 30 members are : United Kingdom (96), India (86), Sri Lanka (80), United States of America (79), Indonesia (71), Thailand (65), Nepal (62), Argentina (53), Peru (53), Brazil (51), Chile (47), Bangladesh (38), the Philippines (32) and Morocco (30). (See Annex B) The objectives of the network are:

* to enhance the use of existing FMIS knowledge by facilitating worldwide interaction among irrigation researchers, policy makers, and managers;

* to create an awareness among researchers, professionals, donor agencies and governments of the important role FMIS plays in irrigation and agriculture;

* to increase understanding of the existing FMIS technologies and management practices;

* to develop appropriate methods for technical assistance and support activities for FMIS;

* to identify the lessons learned from FMIS that might improve the performance of agency-managed systems;

* to identify research priorities and stimulate FMIS action-research projects; and

* to identify training and education needs for the design and support of FMIS.

IIMI's role is to serve as facilitator and coordinator and provide administrative support to the network. This role includes organizing and supporting study tours and workshops, coordinating two-way consulting opportunities and providing some common methodologies for undertaking activities by agencies represented in the network. The agenda for the network is set through interaction among members of the Advisory Committee.

2.1 ADVISORY COMMITTEE

A committee was established to advise IIMI on network priorities and future activities. Although the Advisory Committee does not have formal authority for decision making, there is an informal understanding that the recommendations of the committee will be accepted as long as they are within the budget limitations and the terms of reference of the grant. IIMI is responsible for the decision making and for implementing the committee's recommendations and makes the necessary decisions in the implementation process to fit in with its overall program.

The Advisory Committee comprises 12 regular members from Asia, Africa and Latin America as well as representatives from implementing agencies and other networks. Additional resource persons are also invited to participate in specific meetings. Each regular member serves a maximum of four years or four consecutive committee meetings, with one-fourth of the membership being replaced annually. A Selection Committee is appointed by the Advisory Committee for conducting the rotation and replacement of Advisory Committee members.

The first Advisory Committee meeting was held in Bangkok in June 1987 and was funded by UNDP. The purpose was to chart a strategy and structure for the newly created FMIS Network and to suggest Network objectives and activities for the next four years. Four more meetings were held: in March 1988 in Bangkok, in July 1989 in Colombo, in March 1990 in Kathmandu, and in March 1991 in Manila.

A three year plan for the period of 1991-1993 was recommended by the Advisory Committee identifying the need for more research, workshops and information. The Committee devoted the last meeting to reviewing the lessons learned so far in FMIS as a first stage in identifying key parameters of FMIS that should be considered for adoption, dissemination or improved intervention.

2.2 FMIS NEWSLETTER

The main link between the network members is the FMIS Newsletter. It is an important outlet for research results and a useful channel for sharing experiences. The bulk of the text of every issue is contributed by non-IIMI members. In the future, additional material will be solicited from Francophone countries in Africa, where most irrigation activities are small-scale and farmer-managed, as well as from Latin America. Readers' reaction has been very positive, and the mailing list continues to grow. It is intended that selected portions of the Newsletter will be translated into Spanish and French editions to help overcome the language barrrier in sharing experiences across countries and to reach a wider target audience. Eight issues of the Newsletter have been produced to date and the ninth is in production.

2.3 STUDY TOURS

A series of study tours for FMIS professionals was separately funded through a UNDP grant administrated through the Network. Fourteen individuals participated in six different visits which resulted in comparative FMIS reports. Excerpts of these reports appeared in issue No.6 of the Newsletter.

2.4 WORKSHOPS

Six workshops have been conducted: two international, one regional and three national. A national workshop is scheduled to be held in Bhutan in August 1991. The outcomes of the workshops are described in the following sections:

2.4.1 THE INTERNATIONAL WORKSHOP ON "DESIGN ISSUES IN FARMER-MANAGED IRRIGATION SYSTEMS"

This was held in Chiang Mai, Thailand, from 12-15 December 1989. This workshop was jointly organized by IIMI and the Thailand Research on Irrigation Management Network (TRIMNET) and funded by IFAD/BMZ project, United Nations Development Program (UNDP), and IIMI. Over 70 representatives from 19 countries in Asia, Africa, Europe and the Americas participated in this workshop. Participants shared experiences and discussed issues related to the importance of designing irrigation structures that facilitate sustainable operation, maintenance and management by the farmer water users. Engineers, irrigation specialists, social scientists, and researchers from national government agencies and research centers, private voluntary organizations, donor agencies, and private consulting firms contributed their expertise. The exchange of information and experiences focused on identifying the shortcomings of present design methods and procedures, describing methods for tapping farmer experience and knowledge during the design process, and presenting innovations and alternative approaches that have been tested.

Most of the literature in recent years related to farmer-managed irrigation systems is heavily social science oriented and concerned with the institutions and organizations that farmers have created. How management capability or institutions such as water rights influence the way in which farmers have designed and maintained their hydraulic structures has received less attention. Therefore, the workshop was an important step in drawing attention to the importance of the design processes and design outcomes in searching for ways to improve and sustain farmer management of irrigation systems. The purpose of the workshop was to identify the essential features of a design process that will lead to producing design outcomes supportive of higher farmer involvement in routine operation and maintenance activities. Following are some important outcomes of the workshop, whose proceedings were recently published.

Characteristics of a good design process. Five elements of a good design process that would lead to the construction of an appropriate system layout and structures were identified. Such a process should:

- Be policy-driven. Experiences in Nepal demonstrate that when consultants have clear, well-defined terms of reference stating the need for farmer involvement, a higher degree of success is achieved. Experience also indicates that policies have to be flexible in order to accommodate farmers' needs, and that it is important for governments to give water rights and ownership of the irrigation facilities to the farmers.

- Be field-based. Decisions regarding what types of structures are to be built and where to place the structures should be made in consultation with the farmers in the field. In this way, the designers can see the actual physical conditions and the farmers can respond to the designers' suggestions. To achieve field-based design, governments and agencies must reduce formal design-requirements, simplify bureaucratic procedures, and allow flexibility.

- Have farmer participation. It is important that farmers be involved in all aspects of designing for farmer-managed irrigation. This includes farmer participation through frequent meetings and dialogues between farmers and agency staff so that the farmers can set priorities; making joint decisions regarding financial contribution and use of resources; and selecting design options. One of the most important considerations for effective farmer participation is the attitude of the individuals on the design team. The team must have a positive orientation and be sensitive to interpersonal relations to encourage participation.

- Include learning procedures. Engineers and social scientists need orientation and training to identify and accept the farmers' logic. At the same time, farmers need to learn from the technical teams. To encourage and enable this learning exchange to occur, designers need to go to the field repeatedly.

- Incorporate local logic, knowledge, and experience. Workshop presentations highlighted a number of cases in which the use of local knowledge and experience resulted in improved farmer operation and maintenance of the system and lower cost of the improvements. There was also documentation of cases in which local knowledge and experience were not used, resulting in structures that were unused or altered by the farmers. The farmers' criteria were identified as important considerations for achieving a good outcome that would support operation and maintenance by the water users. During the data collection and design process, both the data and the agency's criteria need to be tested against the farmers' criteria. The priorities of agency and farmers are often not the same; therefore, repeated interaction is necessary to reconcile the two.

Design Process Innovations. Innovative procedures that improve the process of designing for farmer management include: (1) participatory rural appraisal involving farmers in evaluating their problems, priorities, and resources; (2) having the irrigators mobilize all of the labor for construction instead of using contractors; (3) having all financial accounts and transactions for inspection by all parties; and (4) farmer-to-farmer training using farmers from a well-managed irrigation system to train other farmers.

Characteristics of a Good Design Outcome. Good system layout and hydraulic structures for farmer-managed irrigation systems have the characteristics of simplicity, equity, affordability, flexibility, and controllability.

It is important that the design of the irrigation infrastructure should be simple so that all the water users can participate in operation and maintenance. Studies indicate that farmers prefer to minimize channel divisions and levels of network hierarchy and to combine conveyance and drainage functions in the same channel. The structures should support the farmers' perception of equitable distribution and should also be low cost so as to utilize the users' own resources. A good design outcome should enable the farmers to make use of multiple sources of water under varying physical conditions and also allow for changes to be made over time if the farmers' needs and water rights change. For farmer management to occur, the farmers need control over the water from the source to the fields. This encourages a higher degree of involvement and accountability among the water users.

Design Outcome Innovations. One innovative irrigation structure, described at the Workshop, uses low density polyethylene sheet-lined tanks for storing water. Water proportioning weirs for distributing water to users within the command area can be simple devices, often made of wood. The openings have fixed widths to divide the discharge from a single canal into two or more lower-level canals according to the water rights of the users of each canal. The advantages of the proportioning weir are that there is little variation in accuracy over a wide range of discharges, proportional division is easily verified and requires a low-level of management operation once it is installed and operating successfully.

A low-cost standard design structure was developed in northeast Thailand to replace the earth dams. The design was based on an analysis of many sites where dams had failed and on the study of the farmers' experiences. The advantages of such a standard design are the variable crest height, inexpensive stop logs used, and a reduction in maintenance requirements.

A modular precast concrete block weir was developed by farmers in northern Thailand which helped farmers who were having difficulty in maintaining traditional bamboo, wood, and stone diversions. A hollow concrete block was designed to be precast and then bolted together to form a diversion weir. The precast hollow block was a 50cm cube weighing 145 kg. The precasting was done by the water users during the slack agricultural season, using sand and gravel from the river. Assembly of the diversion is done in stages and this allows a very flexible design, both in timing of construction and in the height of the diversion.

An Agenda for the Future. According to Workshop recommendations, the next steps to be taken under the FMIS Program should be further investigation, action research, and transfer of information to irrigation agency staff responsible for planning and designing irrigation systems for farmer management. The following are some key issues and strategies identified at the Wworkshop as needing attention:

- Documentation of the value and impact of FMIS at national levels, including the value of the infrastructure constructed by the farmers.

- Comparative field studies of the economic costs and benefits of FMIS against jointly managed systems.

- Evaluation of the effect of government assistance on the performance of irrigation systems. This will help to influence policy and investment strategies in the future.

- Development of more national networks and professional groups to promote increased and regular exchange of experiences.

- Improving the professional capacity of engineering graduates and planning in-service training programs for professional engineers to include the sociotechnical aspects of irrigation.

The Workshop proposed a future action plan to further strengthen farmer management of irrigation systems. The creation of more national networks and professional groups to promote increased and regular exchange of experiences was recommended. The FMIS Network could encourage the creation of these associations and help establish regional links. Improving the professional capacity of engineering graduates and in-service training of engineers were two areas that need attention. Professional groups were engaged to promote the incorporation of the lessons learned into engineering curricula.

2.4.2 AN INTERNATIONAL WORKSHOP ON "DEVELOPING AND ASSISTING FMIS IN NORTH AND WEST AFRICA"

This was held in Rabat, Morocco, during 15-19 May, 1990. The Workshop, organized by a committee in Morocco and coordinated by the IIMI office in Rabat, was funded by the IFAD/BMZ project, UNDP, the Ford Foundation, the International Development Research Center (IDRC) and the Caisse Centrale de Cooperation Economique (CCCE). Eighty-three participants from around the world attended. This included 27 national participants from 15 countries (Algeria, Argentina, Burkina Faso, Chad, Egypt, Mali, Mauritania, Mexico, Morocco, Niger, Nigeria, the Philippines, Senegal, Sri Lanka, and Tunisia), as well as other experts from such entities as the World Bank, IFAD, UNDP, the International Commission on Irrigation and Drainage (ICID), the Overseas Development Institute (ODI), and the United States Agency for International Development (USAID).

The main objective of the Workshop was to share experiences across countries in developing new systems managed by farmers and in improving the existing ones. To achieve this, the Workshop included specialists from various origins, including managers, researchers, policymakers, donors and international experts. Another objective was to facilitate an exchange of experience and transfer of information concerning problems of irrigation management by farmers and their associations, either by themselves or with public assistance. The Workshop also attempted to discuss alternative strategies of assistance to improve the performance of farmer-managed irrigation systems, taking into account the diversity of social, technical, economic, legal, and financial environments.

The workshop was organized around three themes: 1) traditional irrigation techniques and different types of FMIS found in North Africa and in West Africa; 2) fundamental questions concerning irrigation policy in North and West Africa (focusing on design and management of FMIS and on legal aspects) and; 3) transfer of experience between Africa and the rest of the world (mainly Latin America, South Asia and Southeast Asia). The following are some of the key insights that emerged at the workshop.

Knowledge of Traditional Techniques. It seems that the traditional techniques used by African FMIS and their social organizations (oasis, village or tribal systems) are not widely known and a very limited number of papers described them (the most frequently described being the oasis system). These include depression irrigation (irrigation of lower land using the remaining rains or infiltration from adjacent high zones), controlled flooding (gravity diversion of flooding to specific fields), khettaras (underground water collecting and conveyance canals) also known as korats in the Middle East, norias (rotating devices to lift water from a river or a well), shadufs (counterpoise lifts), etc. Further development of knowledge of traditional techniques including the management processes could be based on research, exchanges of information, and demonstrations on pilot projects. Participants proposed more comprehensive analysis of system typologies, systematic inventory, and case studies.

Performance of FMIS. Many African FMIS achieve rather good results; others have low or limited performance. It is regrettable that quantitative data about the performance of FMIS are not available because of the limited attention paid to their measurement. For Africa, the participants ranked the possible causes of low performance in the following decreasing order: (1) sociocultural factors; (2) institutional factors; (3) economic factors; 4) legal factors; (5) financial factors; and (6) technical factors.

Participants proposed to capitalize on their experience and start a database on existing FMIS to develop case studies and to promote the concepts and methods used in different places. It was also suggested that a common taxonomy about FMIS would prevent misunderstandings, especially between different regions of the world.

Public Assistance to FMIS: It was agreed that public assistance should heavily emphasize new FMIS. The governments should not be directly involved in the routine management of FMIS. Rather, they should remain in their role as catalysts, creating a favorable environment for the evolution, improvement and sustainability of these systems. The participants gave the following examples of governmental actions able to favor FMIS:

1. Development of a long-term policy on agricultural prices (mainly to avoid erratic and unpredictable fluctuations).

2. Betterment of the general level of education of the farmers (the majority of farmers managing irrigation systems in Africa are illiterate).

3. Implementation of extension services and technical consultants.

4. Incentives for the banks loaning money for the development of FMIS or the creation of banks specialized in agricultural development.

5. Formulation of laws allowing the creation and development of associations.

6. Limiting extreme inequalities in land tenure and water rights, sometimes through policies of "agrarian reform" or "agrarian revolution," or new water policies.

It was suggested that the governments, along with the farmers, should play a major role in the rehabilitation and modernization of FMIS. Governments should not turn over nonviable irrigation systems to farmers, but they should improve them prior to turnover. It was also suggested that it may be worthwhile to research the most efficient procedures to transfer the management of an irrigation system from an irrigation agency to farmers' associations.

International Exchanges. The participants unanimously agreed that international exchanges and cooperation could facilitate the development and improvement of African FMIS. In particular, participants expressed an urgent necessity of implementing more permanent relations between the different countries of North and West Africa. However, they expressed reservations regarding the direct transferability of approaches from outside Africa. It was, however, agreed that knowing experiences from other continents may be useful, but these experiences cannot be generally duplicated in Africa without important adaptations because of the differences in human, economic, and physical environments. West African participants seemed more attracted by Asian experiences than by Latin American experiences. The intercontinental exchanges should deal with all aspects of FMIS, whereas African exchanges should be more focused on: 1) irrigation techniques and the organization of water distribution; 2) the establishment of users' associations (including legal status) and their working rules; 3) cropping techniques; and 4) the conditions for transfer of irrigation management from governmental agencies to farmers.

The most commonly cited media for international exchanges included a specialized newsletter, study tours for FMIS managers and workshops, seminars, and other types of meetings. Case studies, training sessions, and research involving several countries were also mentioned.

Many participants felt that it was almost impossible for African governments to develop a network of international exchanges on FMIS through bilateral contacts. Only an international organization, such as IIMI, has the necessary capabilities to manage such a network. This network should not be limited to government officials and engineers, but should include farmers, researchers, agronomists, sociologists, and policymakers. It was felt that such a network could benefit from the creation of a data bank on African FMIS. However, it was pointed out that the development of a network between countries having no common language would be seriously handicapped by the absence of interest of almost all donors for breaking language barriers.

The proceedings of the workshop are in the process of production.

2.4.3 A REGIONAL WORKSHOP ON "THE ROLE OF SOCIAL ORGANIZERS IN ASSISTING FARMER-MANAGED IRRIGATION SYSTEMS"

This Workshop was held in Khon Kaen, Thailand, during 12-15 May, 1989. The Workshop was organized jointly by IIMI and TRIMNET and funded by the IFAD/BMZ Project and the Ford Foundation in India and Indonesia. Participants came from nine countries in South and South East Asia: Bangladesh, Bhutan, Indonesia, Laos, Nepal, Pakistan, the Philippines, Sri Lanka and Thailand. The Workshop was divided into three phases. Initially fifteen presentations were made on FMIS experiences and research in the represented countries. The second phase of the Workshop consisted of field trips to two small-scale Royal Irrigation Department project sites. The third phase entailed small group discussions on issues jointly identified from the discussions and field trips relating to the role of social organizers in assisting FMIS.

Workshop participants agreed that social organizers are effective tools for increasing farmer participation. Social organizers serve as intermediaries between farmers and agencies. They can be effective instruments to facilitate the formation and development of farmer groups, particularly their internal organization, and to improve the relationship and communication between farmers and agencies. The use of social organizers in FMIS assistance programs has shown great promise in the Philippines, where it has been well documented in the Communal Irrigation Project. Partially on the basis of this experience, social organizers have been incorporated into the development strategies of several countries in South and Southeast Asia, where assistance to the FMIS sector is a high priority.

There is evidence from recent experience that active farmer involvement and participation in irrigation management results in increased self-reliance and a sense of ownership. Models of inappropriate participation in the past illustrate the need to review and evaluate approaches taken previously in order to involve farmers in irrigation development.

The Workshop was devoted to the role social organizers play in assisting FMIS. Based on the sociocultural and political context of the different countries, various titles are given to the social organizers; these include Community Organizer, Institution Organizer, Farmer Organizer, Farmer Irrigation Organizer and Social Mobilizer. Regardless of the title, their main task is to serve as liaisons between the farmers and the government agency in an irrigation development strategy and to act as "catalysts" to enable local farmers' organizations to develop.

The social organizer may deal specifically with irrigation-related activities, or with multipurpose issues like the "Group Organizer" in Nepal. Organizing farmers with a "team approach" is often used as a substitute for the more intensive social organizer specialists. Many agencies are now experimenting with this model. In Thailand, the Mobile Campaign Units in the People's Irrigation Project consist of a triple-discipline team, but due to the limited intensity of their visits a great deal of success is not anticipated. In Sri Lanka, a team approach consisting only of government officials from different agencies was designed to effectively implement water management programs, but failed to incorporate farmers into the operations and the desired results failed to materialize.

A number of alternative approaches for generating farmer participation are possible, depending upon the particular country conditions. For example, the social organizer could be one person or a team with a role developed and implemented under a single agency. Alternatively, it could be a matter of coordinated efforts among research institutions, irrigation departments, and farmers. An additional possibility is to encourage the involvement of universities in the formulative period of testing and experimentation.

Determining an appropriate form of social organizer intervention requires an assessment of the specific national policy, organizational structure, program and project characteristics, as well as community conditions. The social organizer's qualifications, recruitment process, supervision, incentives, motivation, and criteria for evaluating effectiveness are important determinants of success.

There is a need for flexibility in the implementation of social organizer programs to ensure the sustainability of the farmer participatory approach. After the withdrawal of the social organizer, the performance of water-user institutions in management and maintenance should be monitored to evaluate system sustainability. As an essential basis of system sustainability, "externally" introduced elements cannot replace self-management. This means that the social organizer has to strengthen the "internal element" of farmer organizations, making system-sustainability a built-in aspect that would not be withdrawn.

The role of social organizers is similar to that of the NGOs. The social organizers have really become the "catalyst" for most of the recent NGO activities, where NGO programs are implemented by means of some kind of social organizer who would be an accepted element in the rural communities, where intruders are not welcome.

The effect of using social organizers has been reflected in most of the government and nongovernment directed assistance programs in many of the Asian and African countries. A bureaucratic intervention approach has not shown successful results, while community-centered social organizers have made a tremendous impact on sustainable management.

During the final session of the Workshop, several follow-up ideas were suggested: to exchange ideas, experiences and information through the FMIS network and the newsletter, to hold workshops on both national and international levels to address institutional and technical interface issues, and to develop a mechanism for effectively integrating these issues into irrigation development. The final recommendation was to renew and assess the situation of each project in each country to develop clear strategies for convincing the decision maker to work for policies and procedures which will truly support development of farmer participation in FMIS. The proceedings of the Workshop have been published and disseminated.

2.4.4 A NATIONAL WORKSHOP ON "RAPID ASSESSMENT METHODOLOGIES SUITABLE FOR MINOR IRRIGATION SYSTEMS IN SRI LANKA"

This was held in August 1988 with the participation of 31 representatives from various government agencies. The main objective of the Workshop was to discuss and improve the set of guidelines developed by IIMI in cooperation with staff from the Regional Development Division and the Badulla District Integrated Rural Development Project (IRDP) office. During early 1988, the guidelines were tested in Badulla and later in Kurunegala, and the reports of the two agencies (IRDP offices) formed an important part of the discussion during the workshop. The use and limitations of the guidelines were also discussed. A working paper titled "Guidelines for Rapid Assessment of Minor Irrigation Systems in Sri Lanka" has been published based on previous research work and the Workshop discussions (Working Paper No. 14). The rapid assessment guidelines presented at the Workshop are useful tools when there is no single approach that will work in all situations. Similarly, the guidelines could be adopted to a range of information needs at various stages of project implementation.

The assessment guidelines have been extensively used in Badulla for monitoring the completed small-scale irrigation systems (both weirs and tanks) improved under the Integrated Rural Development Program. Over 60 such schemes were assessed by project officials during the period 1988-1989. The project officials are planning to use the assessment guidelines as a routine practice to monitor the already completed 191 schemes and future schemes, leading to corrective measures for better system functioning. Experiences gained will also be used to assess other World Bank funded projects like the Matale and Puttalam IRDPs in Sri Lanka.

2.4.5 A NATIONAL WORKSHOP ON THE "ROLE OF NGOs IN THE IMPROVEMENT OF MINOR IRRIGATION SYSTEMS IN SRI LANKA"

This was held at IIMI's headquarters in March 1989. Over 30 government organizations and NGO (i.e., non-governmental organizations) personnel from Sri Lanka participated in the Workshop. Eleven papers were presented and discussed. The Workshop was organized jointly by IIMI and the Agrarian Research & Training Institute (ARTI). The proceedings of this Workshop were published as Working Paper No.18.

The Workshop on the role of NGOs in assisting FMIS opened the doors for inter-agency discussions and relationships and to learning from each other's experiences. Accounts of successful experiences were presented about NGO interventions in the systems where, for the first time, farmers were involved in designing and planning of physical improvements and overall management. The Workshop's recommendations provided future directives for farmer managed irrigation systems aiming at sustainable functioning of systems.

In most cases, the NGOs have developed bottom-up strategies to improve the functionability of FMIS, not only in Sri Lanka but also in other third world countries, as opposed the top-down approach of many state interventions.

According to many observers, NGOs are in a unique position, by virtue of their links with rural communities, to assist farmer-managed irrigation systems. The prospects are immense for using NGO-originated farmer mobilization approaches to develop irrigation schemes. Village institutions would certainly have a longer life as far as the existence of farmer organizations are concerned. A "natural" kind of farmer involvement in the development process would result in a state of self-ownership where there is no need to actually "withdraw" or "hand-over".

NGOs have more flexibility in undertaking projects and appear to respond more to farming-community needs and less to political pressure. As a result, they are better able to deal with equity concerns and to target their efforts toward disadvantaged groups. Policymakers should encourage and facilitate these flexible approaches. NGOs can choose projects and communities neglected by government agencies due to often rigid, technocratic selection criteria. On the other hand, national level NGOs often suffer from lack of technical expertise. In this case, mobilizing expertise and skills available in government agencies can have a positive impact on NGO performance. Often, cooperation and coordination among NGOs is necessary to draw from each other's organizational skills and training facilities.

A disengagement plan, specifying when and at what point the NGO will withdraw from active involvement, would best serve system sustainability. Farmer organization development, management capability, savings accounts and local finances, trained members and leaders, are some of the most often cited indicators of system sustainability. Identification of key persons from within the community to act as catalysts has an implication for sustained system management. Such persons should have a permanent interest in the particular community.

NGOs, as well as governments, which exist to serve people, have their own limitations which can be overcome by collaborative operations. It should be recognized that NGOs are not alternatives to government organization but, rather, are meant to be complementary and supplementary to government efforts. The fact that NGO staff are not bound by government rules and regulations gives them greater flexibility and freedom to venture beyond what government organizations will normally be able to do.

Action research to identify and evaluate the various factors that determine NGO performance in comparison to government performance is important to a better understanding of farmer-managed systems. Evaluation of completed projects is often neglected and it is important to understand processes or sociopolitical factors that effect sustainability.

The biggest pitfall governments are prone to is that they fail to involve the farmers from the beginning of projects. Bringing farmers into the picture only during the latter stages of development fosters a lack of confidence in the government on the part of farmers. In other words, farmers cannot be mobilized to contribute to the project if "they are put last." It was shown by the previously-mentioned NGO studies that some of the national NGOs have implemented programs giving farmer input high priority, which in turn won the farmers' confidence.

NGOs can provide certain types of assistance more effectively than government agencies. However, careful consideration should be given to what the NGO is expected to initiate, how the objectives and approach of the NGOs suit the strategy of the program, and what can be expected from supporting agencies. Although the Workshop was limited to NGO's in Sri Lanka, some lessons are relevant to NGOs in other countries.

2.4.6 A NATIONAL WORKSHOP ON "ENHANCING SUSTAINABILITY OF SYSTEMS REHABILITATED WITH NGO ASSISTANCE"

This was held in Colombo in November 1990. The one-day Workshop included 22 participants who represented relevant NGOs, government agencies and IIMI. As a follow-up to earlier work on NGO assistance to FMIS in Sri Lanka, a small-scale research study was conducted by IIMI during the latter part of 1990. The two NGOs that were included in this study (National Development Foundation and National Freedom From Hunger Campaign Board) presented their experiences in regard to system sustainability.

The Workshop highlighted a number of elements in operationalizing the concept of joint management and user participation. These include, preliminary identification of needed improvements by farmers, joint inspection by the NGO and the provincial irrigation agency, preparation of the design and estimates by a technical department, construction of structures by technical people, and creation of a mechanism to link the NGO to the technical personnel.

It was also observed that while the tank-level organization should be consolidated in order to derive the full benefits, the next stage should be to federate at a higher level (i.e., between tanks along a cascade). One of the main constraints to longer-term sustainability is the lack of a legal status for the organization although they often develop their own bylaws.

The main conclusion was that to enhance system sustainability it is of paramount importance to maintain physical, economic, organizational, and ecological components as interlinked elements of one system, which is the challenge NGOs have to meet in the near future.

3. DIRECT RESEARCH

Direct research is conducted in collaboration with colleagues from national-level agencies and includes both long-term case studies and rapid appraisals. Based on the mutual interests of IFAD and IIMI, six countries have been included in the study: Sri Lanka, Thailand, Bhutan, Pakistan, Bangladesh and Morocco. The greatest part of the work to date has been conducted in Sri Lanka. Research in Thailand, Bhutan and Morocco began in late 1988 and early 1989. In Pakistan, research began only in 1990, and work will soon begin in Bangladesh. The Research has focused on documenting assistance strategies in various systems under rehabilitation, on training, and on strengthening national research capacity.

3.1 SRI LANKA

The FMIS research program was conducted through the IIMI field operations office in Sri Lanka. A number of separate, but related activities were carried out.

3.1.1 ASSESSMENT METHODOLOGIES:

The assessment guidelines developed in 1987 for the IFAD-financed Badulla Integrated Rural Development Program (IRDP) were refined and tested during 1988 jointly by IIMI and the project staff. The guidelines provide a "half-a-day" rapid assessment procedure by which IRDP staff make a preliminary evaluation on irrigation improvements carried out at a given location. The slightly modified guidelines were tested by the project staff of Badulla and Kurunegala and their experiences were presented at a national Workshop held in August 1988. The assessment guidelines based on this Workshop were developed into a Working Paper in 1989. A follow-up assessment was carried out in late 1989 in both the original IRDP districts. Some 61 small irrigation schemes have been assessed by the Badulla project staff and they have made arrangements to assess all the proposed schemes, once they are completed, as a joint undertaking by the IRDP staff and the officials of the Department of Agrarian Services. In Kurunegala, before the IRDP was terminated at the end of 1988, project staff used the guidelines to evaluate 37 completed schemes. Both sources reported that the guidelines are useful and could be adapted for the assessment of other projects.

The uses of rapid-assessment methodologies were observed to be varied and flexible; these provide qualitative insights from which the routine statistical data take on new meaning. The guidelines suggest ways in which officers and planners can gather information that will be immediately useful, allowing them to make appropriate decisions for the improvement of the system.

3.1.2 ASSISTANCE STRATEGIES:

Using the assessment methodologies discussed above, two assistance strategoes were studied during 1988-1989. The first involves the IFAD co-financed Anuradhapura Dry Zone Agriculture Project (ADZAP), which was studied during June-September 1988 by IIMI research staff with the assistance of technical staff of the Department of Agrarian Services. The full report was published as Working Paper No. 16. The findings of this research were presented at a workshop held at the Agriculture Research and Training Institute (ARTI) in April 1989.

The rapid-assessment survey of the irrigation component of the ADZA Project highlights the rehabilitation process. Two sets of policy implications were learned from this study:

- Greater emphasis should be given to upland cultivation, especially in the early stages of project development. Land-shaping in the command area requires more labor than the upland area and farmers prefer upland cultivation when there is no reliable water supply for irrigation.

- Farmers should be involved from the very beginning of the rehabilitation process, allowing them to give input on planning, designing and construction of their irrigation systems. This conclusion is derived from the negative results observed when farmers were not consulted. Farmers have many reasons and incentives for participation and should clearly understand the benefits of their involvement. In this particular case, there was no carefully-designed system for selecting farmers; some had already settled and had good house locations with small enterprises. This meant that they had little motivation to participate. Such farmers are easily discouraged when conditions fall short of their expectations such as when there is no reliable water supply.

Following the assessment strategy used for the ADZAP project, another assessment study on a nongovernment assistance program titled "Alternative to ADZAP" was carried out in Anuradhapura district. The NGO-style tank rehabilitation program of the Sri Lanka National Freedom From Hunger Campaign Board was assessed during the latter half of 1989. The major findings are that this program has looked into the components of (a) land consolidation of chena (upland) farmers, (b) legal ownership of the land they cultivate, (c) selection of smaller systems (3-10 families) owned by one extended family, (d) participation of farmers in physical improvement of the tanks and using only their labour for construction, and (e) provision of assistance to highland farming, dugwells, and community facilities. In the implementation of this program, some drawbacks were also discovered: the top-down bureaucratic control, the long time taken for construction work and the delay in receiving assistance by farmers.

Further study on the role of NGOs in providing organizational assistance to irrigation in the Hambantota district was conducted by a consultant during 1989. A summarized paper on the findings of this study was presented at the Workshop on the role of NGOs held in March 1989. The full report of this research has been developed into a Country Paper and published (Country Paper - Sri Lanka No. 5). The study is of direct relevance to the IFAD-funded IRDP in Badulla district where NGOs have thus far not been used in the irrigation component of the project.

A study of rehabilitation of small diversion and reservoir farmer-managed irrigation systems that was conducted in 1988 in Ratnapura, concluded that attention should be focused on activities relating to the technical and institutional aspects. In order to integrate the technical and organizational aspects of irrigation rehabilitation, there exists a great need to involve farmers more effectively in every phase of the rehabilitation process. This study revealed that: 1) the VIRP intervention has disrupted the existing patterns of water distribution; 2) cultivators felt that the rehabilitation of headwork was more beneficial than modifications at the tertiary level where property rights were entrenched; 3) the implementation process was hampered by lack of institutional relationship between the technical department (ID) and the institutional department (DAS); and 4) there is an inadequate institutional basis for the formation of a tank committee.

A review of alternative strategies for improving farmer-managed irrigation systems in Sri Lanka was carried out by an IIMI Research Associate. This study reviews five government and nongovernmental strategies as alternative interventions implemented during the last two decades in Sri Lanka. The review was developed into an IIMI Country Paper (No. 7) and published in June 1991. In this study, three major governmental interventions and two NGO interventions were reviewed as alternative strategies. It was found that government-initiated alternatives with a strong top-down, centrally controlled approach have created a high dependency on the state for system management, while the NGO-initiated strategies, which use a catalytic approach, show successful results because farmers were involved throughout the rehabilitation process. Although some NGOs operate on a small-scale, they have proven that their strategy could be replicated and could achieve sustainable system management which in turn creates a "sense of ownership" among farmers. This is the key to implementing successful farmer-managed irrigation systems.

The following activities were carried out during 1990-1991.

1) IIMI has contracted for a study on irrigation decision-making and social organization by the Department of Geography of the University of Peradeniya. This study is supplementary to the on-going SAREC (Swedish Agency for Research Cooperation) study on "Tank-Cascades" in Kekirawa (Anuradhapura), which looks at a variety of factors including natural resources, resource management, and sustainable farming. The final report of this study is currently under preparation and will be ready by the end of June 1991.

2) To address the question of social and economic sustainability of FMIS, a study comparing two assistance strategies is being carried out in Elayapattuwa, Anuradhapura as a part of masters'-level research. This study will be completed at the end of 1991.

3) In collaboration with the Department of Agrarian Services, a study to evaluate the performance of rehabilitated FMIS under the Village Irrigation Rehabilitation Project (VIRP) has been commissioned in the Dry Zone, Sri Lanka, to be implemented in the second half of 1991.

4) As a follow-up to the findings of the Workshop on the "Role of NGOs in Sri Lanka's FMIS", an "action research" to identify a methodology towards enhancing sustainability has been started in the North-Central Province of Sri Lanka.

A selected bibliography on small-scale irrigation systems in Sri Lanka, covering such topics as assistance programs, water management, farmer participation, and system performance and management has also been prepared and published. The large number of published and unpublished articles inthe bibliography (250) indicates the importance of small-scale irrigation systems to Sri Lankan irrigation.

3.2 THAILAND (CHIANG MAI)

The rehabilitation of the Peoples Irrigation Projects (PIPs) in northern Thailand has included the construction of small dams, reconstruction of existing traditional weirs, and assisting PIPs to participate in the various stages of the project. Serious difficulties were observed in the rehabilitation process which caused a delay in the implementation stage. One of the major constraints was the large number of departments involved, each with separate budgets and limited coordination. Additionally, it was focused mainly on technical issues with little attention to the socioeconomic aspect.

IIMI is assisting the IFAD-financed People's Irrigation Project (PIP). Under the PIP, upstream reservoirs are being constructed to augment the water supplies of fairly large (several hundred hectares) farmer-managed diversion systems downstream. The individual systems will continue to enjoy organizational autonomy, but will have some new functions, such as liaising with the Royal Irrigation Department (RID), which will control the new reservoirs. IIMI's assistance strategy has targeted three levels: 1) identifying research issues which the project needs to address, 2) Promoting greater interaction on the part of the PIP consultants and officials, with independent but highly relevant studies taking place within the project area; and 3) promoting interest within TRIMNET (Thailand Research on Irrigation Management Network) for the innovative work of the PIP, thereby focusing research attention on that project.

A visit by IIMI staff in February 1988 pursued all the three objectives, with a follow-up in March at the meeting of the FMIS Advisory Committee. A visit in November focused on the second objective. The principle investigator of a 2-year study of the Mae On system (where the construction of an upstream reservoir for downstream regulation of supply to existing people's irrigation systems serves as a prototype for the PIP) was recruited to serve as a consultant to IIMI in backstopping the PIP. This arrangement helped to facilitate the integration of lessons from the Mae On case into the implementation phases of the PIP. Discussions with the Northern Agricultural Development Centre (NADC) and the Northern Resource Management Network (NORMNET) explored possible research activities to be followed up with the consultant. In Bangkok, meetings with the new Director General of the Royal Irrigation Department (RID) and with the Chairman of the Board of Team Consultants underscored the importance IIMI places on the innovative work of the PIP.

During 1989, the consultant made several visits to various agency offices, PIP coordinating units, and sub-project sites, attending and observing the meetings of the Provincial Coordinating Committee, collecting data and reviewing the operation of PIP. An established information exchange linkage has been very useful in increasing understanding as well as further cooperation between the researchers of Chiang Mai University and the PIP staff. The consultant identified some constraints and weaknesses of the PIP operation which require external support from local teams and researchers. The role of the consultant during the second half of 1989 was to serve as a lobbyist in promoting the gathering of information to support the objectives of PIP and as a facilitator in helping to identify, collect, and analyze information which can be incorporated into sub-project designs.

A draft report which was submitted in early 1990 included recommendations and suggestions for future activities to support the PIP and a program to strengthen the bonds between the different departments, specifying the roles each should play in monitoring and evaluating farmer training and strengthening the farmer organization. One of the unique features of this project is the "Mobile Campaign Unit" (MCU) which is designed as a multi-disciplinary team comprising of members from three agencies: the Royal Irrigation Department, Forestry, and Extension.

The role of the MCU team has been identified as one of the most important factors for improvement of the on-going project operation as well as for future project implementation. Field research was conducted in collaboration with the Wageningen Agricultural University, which sent a graduate student to participate in the research during the period September 1990 to the end of January 1991. The objectives were to focus on the role of MCU team in facilitating the establishment of inter-PIAs, to identify implementation problems and constraints and to recommend ways to improve the performance of the MCU for future development schemes. The data is being analysed and will be published in 1991.

The role of the FMIS network is of particular importance to Thailand, where a national organization (TRIMNET) is already in place. IIMI invited six TRIMNET representatives to visit Sri Lanka, to compare the FMIS sectors in the two countries and for the planning of the Workshop that was held in Khon Kaen in May 1989. That visit strengthened the interest of agency staff in both countries in the potential role of farmers in rehabilitating small-scale systems. Reports of the visit have been published in the FMIS Newsletter (Nov. 1988) and the TRIMNET Newsletter (Jan. 1989).

3.3 BHUTAN

IIMI is supporting the work of the Department of Agriculture in improving the performance of farmer-managed irrigation systems, including the IFAD-financed Punakha-Wangdi Project in Bhutan, as part of a larger assistance role. IIMI's input is being handled jointly by staff from IIMI-Nepal and the Institute's headquarters in Sri Lanka. A first visit in June 1988 resulted in a preliminary work plan, including: 1) a training program in rapid-assessment methods conducted in Nepal in early 1989 for eight irrigation professionals from Bhutan (participants included the staff of the Department of Agriculture which is involved in the IFAD-funded project in the Tashigang district, and others nominated by the department) and 2) assistance in formulating a research program on FMIS. A report entitled "Irrigation Development in Bhutan" was written on the basis of information gathered during this visit, and was published as IIMI Working Paper No. 13.

A follow-up visit in December 1988 focused on the research issues in which IIMI could most effectively collaborate. Of the three research activities which the Department of Agriculture plans to undertake, a decision was made to place IIMI's emphasis on the project entitled "Farmer Managed Irrigation Systems in Bhutan," which seeks to generate basic data on irrigation management in three locations. IIMI has requested that one of these locations be within the Punakha-Wangdi project area; a second location is in another IFAD-funded project in the Tashigang district.

In June 1989, IIMI conducted a two-day training program on research methodology in FMIS for field researchers (section officers of the Department of Agriculture and graduate students of Dutch universities and the Dutch Voluntary Service). With the input of IIMI, a handbook for field research based on guidelines for conducting rapid appraisals was prepared by the team of researchers. The Royal Government of Bhutan intends to use the information collected to develop a training program for district officials. A follow-up visit in October 1989 focused on the FMIS research project and reviewing of the handbook. Two officials from the Agriculture Department of Bhutan participated in the Workshop on "Design Issues in FMIS" held in Chiang Mai, Thailand.

The FMIS research was conducted in three sites, from July 1989 until August 1990, by three groups of Dutch students and Bhutanese officials. The goal was to observe in detail organization and management practices of small- scale FMIS in order to provide information about how these systems function and why they function as they do. The main methodology used was participant observation.

A draft report was prepared to be discussed at a national workshop and to disseminate the research findings. The recommendations to be made at the workshop will be input to frame a new irrigation policy in Bhutan. The date of the workshop was postponed several times and it is now scheduled for August 1991. A manual to guide the field research was prepared to assist Bhutanese officials who undertake such research projects in the future.

3.4 BANGLADESH

As part of IIMI's program in Bangladesh, the issue of groundwater irrigation benefits to the landless will receive high priority. No direct activities were undertaken in 1988 in anticipation of the fielding of an IIMI scientist, which took place in November 1988. Unfortunately, there is still a delay in starting the field research. A workplan is being developed with the hope that research will start in the second half of 1991.

Two sets of backstopping activities have been carried out. A Bangladeshi researcher participated in the FMIS advisory group meetings in Bangkok (March 1988), Kathmandu (March 1990) and Manila (March 1991). IIMI staff participated in a planning workshop, in Islamabad in April 1988, for a multi-country study coordinated by the Dhaka based Center for Integrated Rural Development in Asia and the Pacific (CIRDAP). An overview of that workshop appeared in the FMIS Newsletter No. 4. The FMIS Network Coordinator has been in contact with the researchers in the participating countries. IIMI staff also participated in a regional expert consultation on "The Impact of Small-Scale Irrigation on the Rural Poor" held by CIRDAP in Kathmandu in January 1990.

3.5 PAKISTAN (CHITRAL)

IIMI staff visited the Chitral Area Development Project (CADP) during 1989 to identify areas for future activities. CADP is being implemented through co-financing by the Asian Development Bank (ADB) and IFAD. Besides other components, the project aim is the rehabilitation of 80 farmer-managed irrigation systems and the construction of 80 new systems. In total, an additional 5400 ha. will receive better irrigation facilities through this project. Village organizations will be set up by CADP and implementation of the construction of the irrigation systems will be undertaken by village organizations.

A study of FMIS in the Chitral district was started in late 1990 by the IIMI Office in Pakistan and Development Research & Management Services (DRMS), Islamabad. The objective of the research was to initiate the development of a knowledge base of both physical components and institutional features of indigenous irrigation systems management in Chitral. It is expected that such a knowledge base will be useful to engineers and planners in designing and implementing more appropriate and effective irrigation assistance activities in the District.

Three irrigation systems were selected for study. They were chosen according to specific criteria: (i) that the systems were not new ones, (ii) that they had not received development assistance from government or other programmes in the past 15 years, (iii) that they be "representative" of each of three broad categories of levels of irrigation water availability, and (iv) that each was readily accessible from Chitral town. Systems were selected in the Bakhtoli valley, the Bhumburate valley and the Kooh Valley. The three systems represent conditions of irrigation water scarcity, adequacy, and abundance, respectively.

The field team used Rapid Rural Appraisal techniques in conducting field research. For each system studied, preliminary discussions were conducted in meetings with groups of villagers, including the village elders and those involved with irrigation system operations. This was followed by a direct field reconnaissance of the entire channel and selected command areas, accompanied by a few selected villagers. Additional days were devoted to semi-structured interviews with individual households in each village of the command area.

Irrigation is critical to agriculture in the Chitral District because annual rainfall is very low and concentrated in the short period of late spring through early summer. The main sources of irrigation water are rivers, streams, and springs which are fed by snow and glacial melt. Nearly all the cultivated area of Chitral, estimated at 18,000 hectares, receives irrigation water through about 1000 small, community-owned irrigation channels. These systems are constructed by traditional methods and are all gravity flow. Typically, each irrigation channel serves more than one village, and each village is served by more than one channel.

Irrigation systems in Chitral are very old, with many channels reportedly dating back more than 500 years. The singular features of these traditional irrigation systems are: (i) the sanction of the traditional authorities, (ii) they are undertaken as a collective activity and with costs shared among beneficiaries, (iii) local technology was utilized, (iv) rules and regulations regarding the distribution of the new land and the allocation of water rights are clearly defined, and (v) maintenance responsibilities also are well-defined and an informal system of sanctions ensures compliance.

The definition of an "irrigation system" was not as straight forward as had been anticipated. Three clear choices appear to be available. They are: (i) a single channel is an irrigation system with all villages irrigated by it considered to be part of the system; (ii) the village is the focal point and all irrigation channels irrigating it comprise the irrigation system; (iii) all irrigation channels and the villages irrigated by them in a single geographically defined location, e.g. a valley, make up the system. In this study, the first definition of irrigation system was followed.

There is both substantial seasonal and spatial variation in water supply in Chitral irrigation systems. As a result of these variations it proved to be difficult to establish, a priori, the general condition of availability of water in the system, insofar as actual water availability is with reference both to a particular season and a particular location along the channel. Additionally, characterization of systems as water abundant, water adequate, or water scarce is also related to crop water requirements.

The level of development of water rights and the system of water management in established Chitral systems is directly related to water availability. In water scarce areas, the use rights that have evolved over time are very comprehensive and stipulate the allocation of water among original owners with very specific measures for each user. In water abundant areas, there seems to be no clear system of water rights. Generally, all farmers share full user rights, though head-end users invariably have better access to water supplies than do those at the tail end.

The system of water allocation implemented in water scarce areas is the Sarogh system. Sarogh literally means "warabandi" or irrigation turn-by-turn. The Sarogh allocates water either by time or by flow. Original settlers have more rights than subsequent ones, and users of the original channel have more rights than those who benefit by subsequent extensions to the original channel. Original water rights are not connected to land ownership, but sale of land rights is in conjunction with water rights. Subdivision of land does not affect water rights.

There is no specific institution at the village level charged with irrigation development or management. Channel operation and maintenance is undertaken on an informal basis with each beneficiary household contributing labor for the physical work required for cleaning or repair. There is a distinction between the tasks which are considered the collective responsibility of users and those tasks which are considered the users' individual responsibility.

There were a few roles at the village level traditionally assigned specifically for irrigation management. For example, the clan chief used to be the village irrigation "Mir Joi". However, the position of "Mir Joi" was not encountered in any of the three systems studied. The system of appointing a "joiwal" or the channel guard is also disappearing and there does not appear to be any institution replacing it.

Village-level conflicts among farmers within the same village are normally settled promptly and rather easily. Conflicts between villages are more difficult to resolve and in most cases they require outside adjudication for settlement. Disputes between villages have become more frequent with the prospect of development of the common property resources. There also are more ambiguities regarding the ownership of these high land resources between villages.

Research findings will be published as a Country Paper in 1991.

3.6 MOROCCO (ORMVAH-HAOUZ)

A study of farmer-managed systems that have been recently incorporated into an expanding regional development authority, ORMVAH (Office Regional pour la Mise en Valeur Agricole Du Haouz) was initiated during 1988. The objective of the study was to improve the management capacity of the farmer through better relations between farmer organizations and the ORMVAH. The study was conducted by a faculty member from the Institut Agronomique et Veterinaire Hassan-II (IAV) in cooperation with the ORMVAH. The first phase of the study, in 1989, sought to identify possible causes of low efficiency in irrigation management. In this phase, the study entailed the review of existing literature, field visits, and farmer interviews. A draft report has been prepared with suggestions for further studies in proposed second and third phases. The report will be published in both English and French in 1991.

The report has indicated that the physical improvement of existing FMIS in Morocco without the involvement of the farmers led to a low level of management efficiency of farmers' associations. The involvement of a parastatal agency in the rehabilitation process disturbed the existing equilibrium between farmers, Water User Associations and the ORMVAH. In the case of Morocco, the concept of farmer participation is not yet well-recognized and is rather new. Decision-makers and managers emphasize the engineering aspects to solve performance problems. Two important outputs of the preliminary study were: (a) to give more attention to the non-engineering aspect of irrigation management, and (b) to provide guidelines on the contents of further study.

Basically, three levels of irrigation management were identified in Morocco: ORMVAH, Water User Associations, and the farmers. Various hypotheses were suggested to explain the process of degradation of the relations between each level and within the Water User Associations. The hypotheses suggested for the relation between ORMVAH and farmers' association are related to the degree of involvement of the ORMVAH in water management. The hypotheses related to intra-relations of the farmer associations are based on the ethnic and individual strategy of the members. At the farmer level the hypotheses are related to the behaviour and activities of the farmers including their external activities. This information can serve as a basis for developing an action research program aimed at field testing a pilot project. The outcome of such research will suggest improvements for the relations between ORMVAH and farmer associations in the rehabilitated FMIS of the upper Tessaout (30,000 ha) and will provide guidelines for the rehabilitation of the FMIS of the lower Tessaout (40,000 ha).

4. SYNTHESIS OF FINDINGS AND RECOMMENDATIONS

We repeat here our definition of farmer-managed irrigation systems as irrigation systems in which all routine operational management activities, including water acquisition and movement, system maintenance and resource mobilization, are under the authority and responsibility of the farmer water users. Compared to the agency-built and operated irrigation sector, governments usually pay relatively little attention to farmer-managed irrigation systems. Consequently, the FMIS Program has been working to:

1) demonstrate the importance of the FMIS sector for national food security and for enhancing the living standards of the poorer segments of the populations in Third World countries;

2) identify performance problems and needs for helping to develop the FMIS sector and ensure local sustainability of FMIS;

3) identify effective strategies for meeting the needs of the FMIS sector and help develop it according to national development priorities; and

4) help governments and researchers become more aware of the problems, potential and methods for assisting the FMIS sector.

Of the themes which have emerged from the research and information exchange activities of the FMIS Program, twelve stand out in importance. This set of themes has been synthesized primarily from research financed directly from the FMIS Program, from research which has been guided by or related to the FMIS Program Network, from reports gathered at FMIS-sponsored conferences and workshops, and from other reports and letters in the FMIS Newsletter.

These themes with the attendant implications on research and development priorities are described below. Reference will also be made to some of the information generated and disseminated under the FMIS Program.

4.1 FMIS ARE AN IMPORTANT, YET OFTEN NEGLECTED, PART OF THE ECONOMY OF MANY COUNTRIES

The FMIS sector is more extensive and important for national economies than is normally appreciated. Because FMIS are often located in remote areas, are normally not built by the government, and not reached by government development programs, they are often neglected in statistical surveys and development plans. They are given far less assistance than schemes which are built and operated by agencies. Yet in many countries they constitute a significant part of the total irrigated area and produce an important part of the food supply.

Public irrigation development, which is often characterized by large-scale, capital-intensive interventions that are restricted to specific areas, often leads to an undervaluation of FMIS in most countries. FMIS, however, cover large areas and a great number of beneficiaries, not only in relative terms but also in absolute terms, in most developing countries. This is illustrated by the following table.

COUNTRY	ESTIMATE OF FMIS SHARE[1] Percentage/	x 1,000 ha
NEPAL	67%	608
INDIA	64%	21,030
PHILIPPINES	63%	580
MOROCCO	60%	700
SUB-SAHARAN AFRICA	45%	1,200
PAKISTAN	35%	2,750
SRI LANKA	33%	183
INDONESIA	21%	1,036

FMIS cover a wide range of environments and technologies including among others: gravity systems, groundwater lift systems as well as surface lift systems, and oasis as well as flood recession systems. Farmer-owned and managed systems, estimated to represent more than half the total irrigated areas in many countries, have become the present focus of attention.

Irrigation systems in the Philippines cover about 1.35 million hectares (ha) of land. Of this, about 500,000 ha are in national systems managed by the government's National Irrigation Administration (NIA). Communal systems managed by farmers' irrigation associations, and private systems managed by individual farmers cover 600,000 ha and 250,000 ha, respectively. Thus, 63 percent of the total irrigated area is served by irrigation systems managed by farmers either individually or through their irrigation associations (Bagadion, 1989:265).

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1 These estimates include groundwater development, which is primarily farmer-managed.

According to the Directorate General of Water Resources Development, Department of Public Works, there are about 1,036,613 ha of FMIS in Indonesia. Further data show that the irrigated area under agency management is approximately 3,818,657 ha. Thus, FMIS account for approximately 21 percent of the total irrigated area in Indonesia. Over the next 15 years, the Indonesian government plans to turn over to water users' associations nearly 1 million additional ha of irrigation systems. This will increase the area of irrigated land of FMIS to 30 to 40 percent of the total irrigated area in Indonesia.

Groundwater development is predominantly farmer-managed and is increasing in importance in countries such as India, Pakistan and Bangladesh, where estimated areas under irrigation of 21 million, 2.5 - 3 million and 2.5 million ha respectively, are benefiting from groundwater development activities.

The gross irrigated area in the Indian subcontinent stood at 42 million ha in 1984-85, the latest year for which data are available, with half this area estimated to come under the FMIS sector. This is probably a conservative figure, due to the exclusion of larger tanks on the grounds that these are "agency-managed", despite the fact that day-to-day management is done by users. In addition, an estimated 3 million ha under state tubewells have certainly increased and private tubewells have significantly expanded during the past five years. According to Indian Agriculture in Brief, of a total of 21,030 million ha, the extent of irrigated land under FMIS (in million ha) is: private canals, 495; tanks, 945; tube wells 8265; other wells, 8725; other sources (surface lift irrigation, etc.), 2600.

A conservative assessment of FMIS coverage including area under private tubewells in Pakistan is of the order of 2.5 to 3 million ha, even though official statistics with any degree of reliability of the entire scale or scope of FMIS are lacking. The latest available statistics on private tubewells in Pakistan come from the Water and Power Development Authority (WAPDA). According to their estimates, there were 250,000 wells in 1986, but it is clear that the total number of wells have risen since then. According to some other estimates, the number of private tubewells is in the range of 280,000 and 300,000. It can be inferred that the actual average service under private tubewell (farmer-managed) irrigation is around 7-8 ha, or even less, which would mean that probably no more than 2.5 million ha of tube well irrigated land is farmer-managed at present (FMIS Newsletter No.8, 1990:14,15).

In Sri Lanka, about 550,000 ha are under irrigation in the country, and about one-third of this area is estimated to be under farmer management of primarily small irrigation tanks. The latest estimates suggest that there are about 35,000 FMIS in the country, including tanks and anicut systems (Bandara, 1990:17).

Approximately 350,000 ha are under agency management in Nepal, whereas 608,000 ha are managed by the farmers. The Agricultural Development Bank of Nepal has assisted the development of about 106,000 ha of FMIS. Although there has not been agreement on the extent of area under farmer-managed irrigation, it can be safely concluded that a greater area is under farmer management. An estimated 1,700 FMIS exist in the *Terai* and over 15,000 exist in the hills of Nepal.

Even in Nepal, Government recognition of and response to the importance of FMIS is only a recent phenomenon. As Pradhan notes:

> The First Five-Year Plan (1956-1960) did not even recognize the existence or contribution of farmer-managed irrigation systems. Though the role of FMIS is extremely important in Nepal's agricultural economy, it was only in 1981 that the government acknowledged this and began to consider ways to enhance and expand FMIS. The Irrigation Sector Policy for the Fulfillment of Basic Needs clearly spelled out the distinction and made it clear that FMIS will be managed by the farmers themselves but that appropriate assistance both for physical and management improvement will be provided by the government through the newly established District Irrigation Offices (Pradhan 1989:2).

The total cultivated area in Nepal is estimated to be 3.1 million ha. The irrigable area is 1.9 million ha. Out of this area, 1.6 million ha are in the Terai and 0.3 million ha in the hills. If we combine the farmer-managed systems and agency-managed systems, the total area under irrigation comes to 1,038,000 ha, suggesting about 33 percent of Nepal's cultivable land to be under irrigation. Of this total area, 33 percent is presently agency-managed and 67 percent farmer-managed (Pradhan 1989:3).

Pradhan reports that since irrigation systems constructed, operated and maintained by farmers account for the major portion of irrigated agriculture in Nepal, and conservative estimates indicate that production from FMIS is feeding over 30 percent of Nepal's population, the farmer-managed irrigation sector deserves more attention. The contribution of FMIS to the basic needs of the country is already high, but it can be increased further if assistance programs are carefully conceived and implemented (Pradhan 1989:28).

The Gallery Systems in Morocco which tap subsurface aquifers, are estimated to irrigate 30,000 - 40,000 ha (with similar systems found in Algeria and Iran). Farmer-managed irrigation systems in the Tessaout Plain of Morocco are among the largest in the world, with command areas rising up to 12,000 ha (FMIS Newsletter No. 3 (1988) p.4).

According to the estimate of the FAO Investment Section, the small-scale or traditional sector constituted just below half of sub-Saharan irrigation (2.57m ha). This small-scale informal sector predominates in every sub-Saharan country except Sudan. Despite the extent of current interest in small-scale irrigation, there is very limited research on it within Africa. The information on the ways in which small-scale irrigation schemes are run, or how they perform is extremely scarce, and there are only a few specific comparisons between small-scale and large-scale projects.

Kenya provides a typical example of the nature and importance of FMIS in sub-Saharan Africa. With its population growing rapidly, much of Kenya is too arid to support rainfed cropping. However, although the area irrigated increased in the 1970s, only 2.1 percent of the cropped area is irrigated, when compared to 3.7 percent in sub-Saharan Africa as a whole. The existence of medium to large-scale government-owned irrigation schemes is relatively well-known. Yet there is also an extensive, informal, small-scale irrigation sector.

According to the estimates by the FAO, the area under the informal "traditional" irrigation stands at 57 percent of the total irrigated area, amounting to 28,000 ha in Kenya (Adams, 1990:6 & 7).

Although there are many more examples available, those mentioned above illustrate the importance of the FMIS network. However, the importance is most often not reflected in the allocation of funding of the respective governments (e.g., in Sri Lanka only 5 percent of total funding is allocated to FMIS). Moreover, FMIS are found in areas affected by drought and where they play a strategic role in promoting food security and developing strategies for ensuring that security. There is a need to increase the awareness among government officials of the importance to the economy of the FMIS sector and of the need to find ways to support its productivity and sustainability.

4.2 ASSISTANCE TO FMIS IS LOW COST AND MORE COST-EFFECTIVE THAN ASSISTANCE TO AGENCY-MANAGED IRRIGATION SYSTEMS

Relatively small government investments in the FMIS sector produce proportionately much higher positive returns than is the case for investment in agency-sponsored irrigation. This is largely because the scale of activity is small compared to larger-scale agency systems, projects can be completed quickly, benefits are realized sooner, and farmers are more likely to provide corresponding local investment.

In comparison to large-scale irrigation, public investments for small and medium-scale irrigation have been very small in Morocco. In developing small and medium-scale projects, the Government initiatives appear to come from a sense of welfare and generosity toward peasant farming communities (Bouderbala et al. 1984). Assistance to existing small and medium-scale irrigation sectors has generally been scattered, incomplete and sometimes inconsistent, and is often limited to physical structure improvements such as construction of headwork intakes, lining of main canals and installation of flow measuring devices. Relatively little attention has been paid to developing water user associations, and encouraging farmer participation in construction and management. The small and medium-scale irrigation systems built since independence have usually been planned with the same methodologies used for large-scale irrigation development, and few steps have been taken to ensure their adequate management.

Observers note the following advantages of small and medium-scale irrigation systems in Morocco:

1) They are "closer" to the farmers and thus improving them results in a more rapid increase in agricultural output than improving large and new irrigation projects.

2) The investment costs in small existing projects are lower than in large new projects for an equivalent increase in value added. This assertion needs to be verified.

3) The investments in FMIS are gradual, resulting in high and rapid returns when compared to large projects where it may take decades before a storage dam and conveyance system are completed and are in full use.

4) A better equilibrium between various areas of the country is reached when investments are put in small irrigation projects (SCET MAROC, 1977; and Zaghloul, 1981).

Reporting on FMIS in India, Patil (1989:208) has noted that the farmer-managed systems are superior to agency-managed systems in terms of cost and their irrigation efficiencies.

The gross area under irrigation in Nepal is about one million hectares or nearly one third of its cultivable land area. Of this 33 percent is presently under agency management and the rest (66 percent) is under farmer management. The farmer-managed irrigation systems in Nepal are basically self-governing, autonomous entities. Their contribution to the national economy by the FMIS is substantial, producing about 50 percent of all rice grown in the country (Rizal, 1989:267).

In Senegal, village irrigation systems expanded rapidly along the river valleys; 1,000 ha in 1975, 10,000 ha in 1982, and 32,900 ha in 1988 with more than 1,000 irrigation systems accounting roughly for 67 percent of the total irrigated area. According to Seck (1989:291) the farmer-managed irrigation systems in Senegal which represent 35 percent of the agricultural irrigation contributed 45 percent of the nation's agricultural production from irrigated lands.

It is evident that the productivity of these FMIS is not lower than those managed by state agencies. Small systems however, receive scarce assistance from the government as the criteria followed by the state in irrigation development precludes the use of small water sources, even though the farmers seek to harness any water resource available. Nevertheless, agencies seldom work in inaccessible terrains (Bottral & Pande, 1990:4).

4.3 THERE IS A "POLICY GAP" FOR THE FMIS SECTOR IN MANY DEVELOPING COUNTRIES

Many developing countries lack policies and regulating mechanisms to effectively regulate water use between FMIS in watersheds and along river courses. There tends to be a lack of well-developed laws and policies related to FMIS since the governments have not had substantial involvement in this sector. And yet with increasing population densities, environmental degradation, and a rapid rise in intersectoral water use conflicts and issues, there is a pressing need to develop policies in this area. Also needed are policies aimed at protecting and strengthening the ability of FMIS to be productive and to sustain themselves with only minimal and occasional assistance from the governments.

The above points, together with the financial problems facing many Third World countries, are increasingly pushing governments to take action to improve small farmer-managed irrigation projects. The above problems result in a series of questions related to the appropriate policy to use when dealing with small and medium-scale irrigation, the correct legal framework and particular organization required for that policy to succeed, and the method needed to mobilize both financial resources and farmers to reach the goals. The answers are difficult because of the complexity of the problems and the variety of environmental, technical, social, and political implications of any decision. Small and medium-scale irrigation systems (SMSIS) are a result of a historical process sometimes slow, sometimes violent. Any hasty intervention, however small, will destroy a state of equilibrium with unpredictable consequences. This is why government agencies are so reluctant to interfere with SMSIS, although they recognize the urgency of such interference. A key role is consequently left for research (Abdellaoui, 1989:265).

All states in India now have abolished the unit rate for electricity adopted for pumping in favor of a flat rate charge based on the horsepower of the pumps. The concept of a flat rate is progressive in the sense that the higher the horsepower of the engine, the higher the rate incurred during the year. The electric rate policy is applicable uniformly throughout the state, making no regional disparities in electricity rates or policy within the state.

Furthermore, the flat rate encourages the use of pumps because the marginal costs of pumping are limited to the incremental costs of pumpset maintenance. In fact, under flat rate charges, the pump owner has a strong incentive to pump more than the requirements and sell the surplus at any price. The flat rate system also encourages farmers to increase mechanical pumping efficiency to allow the same amount to be pumped with a lesser horsepower engine. This results in reduced charges for electricity and the drain on the budget of the state electricity board, yet it does not address the basic issues such as declining groundwater levels and unsustainable yields. Recently, the State of Tamil Nadu has abolished all charges for electricity in rural areas.

In brief, we find the state-wide pro-pumping policies to be disastrous in two types of ecological conditions and beneficial in two others. Given these problems and possibilities, an agenda for planning the future of groundwater development in India would include a number of items. According to Ambler, (1991) the following policies are needed:

1) Production of aquifer maps as texts for the negotiation of local groundwater rights, sustainability, and policy.

2) Environmental impact assessment of policy options for government decision-makers.

3) The development of energy pricing policies that are adapted to the different ecological conditions within each state, and which take into account the negotiated settlements of diagnostic stages.

4) Facilitation of an organizational structure for user-management of aquifers through collective action.

5) Decentralization and/or privatization of groundwater regulatory authority.

In the last few years, in Cambodia, the government is making new policies which explicitly support the FMIS sector following the success of an American Friends Service Committee (AFSC) small-scale project in Kompong Chang province. It now appears that small community-based projects will become the responsibility of the provinces whereas the responsibility of medium and large-scale projects will be left to the central government departments (Dumas, 1989:277).

The role that FMIS play in providing the basic needs of Nepal is significant, but it can be further increased if carefully conceived and implemented. Government assistance is directed toward strengthening the infrastructure and management by farmers. Investment in strengthening FMIS to increase their productivity can be achieved at a lower cost than that under the agency-managed systems. The following are IIMI recommendations on policies that the government of Nepal should pursue on the FMIS sector:

1) Provide legislation that establishes the legal identity and rights of the beneficiary groups operating irrigation systems.

2) Identify existing FMIS in the area of each new agency project and incorporate their physical and organizational structures into the system with minimum disruption.

3) Establish uniform assistance policies for each geographical region of the country.

4) Systematically identify all FMIS in the country on a watershed basis by making an inventory that establishes a database giving pertinent details of each system.

5) Establish criteria for selecting systems for assistance.

6) Enable beneficiaries to improve the effectiveness of operation and maintenance activities in their system and to fully participate in any physical improvements that are made by providing assistance to strengthen their organizational and management capacities.

7) Encourage beneficiaries to take responsibility in assisting with selection of the design and in implementation of physical improvements to be made to their system.

8) Ensure the design process for improvements to FMIS is simple and field-based.

9) Give assistance to FMIS in the form of loans (subsidized to the extent necessary) instead of grants.

10) Establish a division in the Department of Irrigation responsible for assistance to FMIS.

11) Provide orientation and training to all levels of departmental staff dealing with FMIS to enable them to implement a participatory approach when assisting these systems (Pradhan, 1989:29-30).

The subsidy policy adopted by the Government of Bangladesh regarding the purchase of deep and shallow tube wells has resulted in the overcrowding of wells. It has now been realized that the government should address such issues as: 1) control of the zoning of deep tubewells, 2) proper location of deep and shallow tube wells to overcome drawdown problems, 3) equal access to credit for landless people and 4) a policy to encourage diversification into non-rice crops during the dry season (Mandal, 1990:17).

4.4 PROBLEMS AND NEEDS OF FMIS DIFFER ACCORDING TO "HYDRO-MANAGEMENT ENVIRONMENTS"

Management problems and development needs differ considerably between FMIS in different types of "hydro-management" environments. We can classify FMIS into four general categories as follows:

1) Gravity flow diversion systems

These are most prominent in Southeast Asia, the Himalayas and in hilly regions throughout Asia and Latin America. This is the type of FMIS which has received the most attention to date, in research and development assistance. Most examples of well-developed traditional organization for irrigation management are encountered in this type. Traditional irrigation societies in Bali, the Philippines, Thailand, Nepal and elsewhere demonstrate elaborate forms of organization for water acquisition and distribution, system maintenance and improvement, resource mobilization and conflict resolution. Currently, the most salient development problems for gravity flow diversion systems tend to be such things as maintenance of the conveyance system in unstable areas, often highly fluctuating water supplies from rivers, conflicts on water rights between systems, viable resource mobilization procedures and effective group rules and sanctions.

2) Gravity flow storage systems

These are sometimes referred to as "tanks," and are prominent in South India, Sri Lanka and northeast Thailand. These systems typically have relatively more stable discharges into the network, on a day-to-day basis, so that more management decision-making is needed on a seasonal planning basis. Siltation is a frequent problem in this type of system. There is also a considerable amount of research which has been done under the FMIS Program on this type of irrigation system, especially in Sri Lanka.

3) Groundwater lift systems

Groundwater irrigation is spreading rapidly in many countries in Asia and Africa. Irrigated areas of lift systems are often overlapping and this creates possibilities for competition in water markets in many areas. The cost returns for small-scale pumps is such that this type is spreading more rapidly than deep tube wells and the smaller pump systems lend themselves to private or individual management more than collective management. Normally, capital rather than labor is the main resource constraint, due to the cost of equipment and fuel. Collective labor is less important than the availability of skilled operators and repairmen.

In Bangladesh, a study by the Bangladesh Agricultural University on groundwater irrigation showed that:

-- minor irrigation schemes have deficiency of pumps, poor water conveyance systems, high canal loss of water, and poor on-farm water management. However, these deficiencies are not significantly related to the performance of tubewells in terms of command area or yield.

-- The most important factors affecting irrigation performance in terms of command area and output were found to be the economic institutions such as the system of payment for water. For example, tubewells operated under the cash payment system performed significantly better in terms of command area and output than those run on 25 percent crop-share payment basis in Tangail. In Gazipur, tubewells run on the manager-supplied fuel system performed significantly better than those operated with the farmer-supplied fuel (Mandal, 1988:20).

If user participation in irrigation development is viewed mainly through construction, and should this be the avenue for group consolidation, then tubewell systems are at a disadvantage. Development of tubewell irrigation systems need skilled labor contribution; tubewells are drilled using special mechanical devices. While local labor can contribute to the construction of channel distributary systems, they should be lined for preventing excess seepage, a task requiring a certain degree of expertise. In addition, as the use of buried PVC pipes is becoming popular in place of open canals, this too ceases to be a candidate for farmer labor.

Furthermore, tubewells offer very little opportunity to test the group's commitment before sizable investments are made, as it is difficult to find out whether the commitment is true until the tubewell is drilled and constructed completed, which is a fairly advanced stage of undertaking.

In tubewells, preventive maintenance is far more crucial when compared to surface irrigation systems. In surface irrigation systems, poor maintenance could result in decreased flow but seldom in complete stoppages. However, in the absence of preventive maintenance, tubewells will deteriorate very rapidly, leading to breakdown of the systems causing a complete halt to irrigation. Tubewell systems are less "forgiving" than surface irrigation systems and hence they need much more applied management.

The kind of expertise required to support tubewell systems and the provision of necessary spare parts are not generally encountered in rural areas. Even the electricity or diesel fuel necessary for well operation are rarely freely available. Almost all studies dealing with tubewell systems point to poor maintenance due to lack of required skills and spare parts, and inefficiencies in the supply of fuel -- electricity or diesel -- as causes of dismal performance of these irrigation systems. Without a well-organized and sustainable infrastructure, tubewell systems are not plausible.

Many small-scale surface irrigation systems are gravity systems. Once completed, there is very little cost involved in the distribution of their waters. Tubewells, on the other hand, are lift irrigation systems and invariably require that energy be used in the pumping operation and that trained personnel take charge in operation of the equipment. Payments in cash or in kind is needed for energy as well as labor for operation.

In small-scale surface irrigation systems, a greater part of maintenance and repairs is physical work of an uncomplicated and an unspecialized nature, which may be carried out by the irrigators themselves. With tubewells however, almost none of the tasks involved in maintenance and repair of equipment can be undertaken by farmers.

The differences between surface and tubewell systems can be illustrated with an example from Nepal. Here, in a surface water FMIS in Nepal, it was observed that the O&M costs were about US$35.00 per ha, of which only US$2.00 were in cash; the rest was the value of labor contributed by the farmers. In a neighboring tubewell irrigation system, O&M costs amounted to about US$50.00 per ha, all in cash.

For many reasons, tubewell systems are complicated and difficult to manage and administer. Some of these are: 1) crucial nature of preventive maintenance; 2) supporting infrastructure being often weak and suffering from frequent shortages of spare part supplies; 3) difficulties in obtaining energy for pump operation; 4) reluctance of farmers to spend money on O&M; and 5) financial requirements for sound management and control.

In summary, tubewell systems have problems which are different from those of surface irrigation systems, particularly in the context of participative approach in management: there is little opportunity for participation in construction activities; there is little opportunity for group formation and consolidation prior to tubewell systems being developed; preventive maintenance is critical for tubewell systems to be successful; a sustainable support system should be available in rural areas if these systems are to succeed; tubewells are largely dependent on factors and systems beyond the control of rural farmers; these systems are cash-incentive in their O&M; and administration of tubewell systems is complicated.

Olin, (1990:8-11) proposes some potential solutions to these problems including: 1) redefining the role at the time frame in the working process of the social organizer; 2) Expanding the user participation as widely as possible in the tubewell irrigation environment; 3) Emphasizing management and control systems relevant to farmer organizations which deal with all spheres of tube-

well system management; 4) Farmer training in using and understanding the equipment and how they work; and 5) Expansion of the participatory process.

The management decisions of private pump owners (whether operating individually or in groups) are dependent upon appropriate support from the government with regard to information concerning aquifer conditions, credit, energy, pricing, water supply and adequate mechanical backup services. In this context, the role required of the central government is mainly that of a "service agency." This is very different from the direct implementation role that governments may be more accustomed to playing in agency-managed systems and calls for very different approaches and skills, most important of which is the ability to interact and work in collaboration with the concerned village or irrigation scheme (FMIS Network Advisory Committee Meeting, Nepal, 1990:16).

4) Surface lift and flood recession irrigation

This is where water from rivers or other surface sources is lifted for irrigation or is directed for irrigation from flood recession lands in low-lying areas. Water can be lifted by pumps in larger-scale operations (such as along the Senegal River Basin) or by traditional lift technology such as the shadouf (which is prominent in Africa and the Middle East). Flood recession irrigation is practiced widely in sub-Saharan Africa along rivers or low-lying repositories of water, such as the fadama in Northern Nigeria. Relatively little research or government attention has been given to this type of irrigation, yet it involves millions of people in West and Northern Africa. There are few experts on this type of irrigation -- apart from the farmers themselves.

It seems that the traditional techniques used by African FMIS -- *depression irrigation* (irrigation of lower land using the remaining rains or infiltration from adjacent high zones), *controlled flooding* (gravity diversion of flooding to specific fields), *khettaras* (underground water collecting and conveyance canals) also known as *korats* in the Middle East, *norias* (rotating devices to lift water from a river or a well), *shadufs* (counterpoise lifts) etc., -- and their social organizations (oasis, village or tribal systems) were not widely known and a very limited number of papers described them (the most often described being the oasis system); this limitation of knowledge includes the management processes. The development of the knowledge of traditional techniques could be based on researches, exchanges of information, and demonstrations on pilot projects (FMIS Newsletter No.8, 1990:2).

Millions of people living along the major river courses in Africa, particularly south of Sahara, practice a type of irrigation which requires little in the way of physical infrastructure, depending upon seasonal fluctuations of flood waters. In Nigeria, the latest estimates show that there is approximately 800,000 hectares under flood water agriculture, and it is estimated that a further 1.2 million hectares could be brought under this type of irrigation. This is obviously one reason why flood water agriculture is important in this part of the continent. While a large number of people practice this mode of irrigation, it is demand-driven; the incentive to practice it comes from the producing household.

In Nigeria alone, there are well over 10 million people dependant on the annual flooding of the Niger River. Despite this, many river basin development projects in Africa have largely overlooked the population living along the river courses.

Scudder (1988:1-5) describes surface lift and flood irrigation in Africa as follows:

> In these rivers, people plant a series of crops on the receding flood as the water goes down. It may be riverine, along the banks of the primary channel, or on extensive flood plains if they exist. Then there is a much more limited distribution of flood rise irrigation, and this is where the floating rice is used. Flood rise irrigation is pretty much restricted to West Africa. In Kenya and perhaps in Tanzania, there is a somewhat different version which I've just mentioned where, when the flood is coming down, the tides are used to force fresh water into the paddies. Then there is a third and very complicated system, which virtually no one has written about, and that is tidal irrigation in mangrove swamps.
>
> There is a tremendous potential of using high technology -- these big dams; Africa cannot afford to not manage these rivers. The combination of regulated floods for recession agriculture, and then the development of village irrigation projects (or federations of them) can enhance and build upon the strengths of millions of farmers whose production systems at the moment are being eliminated by dam construction.

Each of the above four hydro-management types needs special attention and different strategies for research and development. Many FMIS Network members have noted the need to give added attention in the Network, through more research and information exchange, to the second, third and especially the fourth types.

4.5 FMIS ARE NOT ONLY TRADITIONAL; THE AREA OF NEW FMIS IS IN FACT EXPANDING RAPIDLY

FMIS are not limited to traditional systems located in areas not conducive to expansion. Groundwater and other lift irrigation systems are the fastest growing types of FMIS today and need greater investment in research and assistance due to their growing importance.

The most rapidly increasing sector within FMIS in India is undoubtedly groundwater development. Wells are divided into two managerial types: state tubewells (usually medium or deep) and private wells (usually shallow tubewells [STW] or dug wells). By 1990, the number of state tubewells were estimated to have grown to about 64,000 units, whereas shallow tubewells (STW) account for about 4.5 million units. There are 9.5 million additional dug wells in the country. All STW and dug wells are FMIS. The potential irrigated area under FMIS groundwater systems by 1990 is estimated to cover no less than 32 million hectares.

The use of wells for surface water supply has increased rapidly in the command areas. In the drought-prone regions, nearly 200,000 small tanks have been accounted for. Approximately 3.3 million ha were served by these tanks. The majority of those tanks included FMIS in some cases and they are changing the basic function from surface water storage systems to groundwater systems (Ambler, 1991:1).

A second category of fast growing FMIS is that of systems whose management is being turned over from government agencies to water users' associations. This is a very widespread phenomenon with its own particular challenges, given the pressures to create effective farmer-management institutions in settings where the primary irrigation investment is not indigenous. In many developing countries, government agencies are unable to pay for recurrent costs of irrigation operation and maintenance. Ineffective bureaucracies often have poor management performance records. At the same time, there is increasing agricultural diversification and commercialization. There are also increasing numbers and types of rural nongovernmental institutions. These changes are leading many governments in developing countries to privatize irrigation institutions and turn over their management to water users' organizations, or other nongovernmental bodies.

Through privatization and turnover, new FMIS are being created from formerly agency-managed systems. Governments are expanding the role of non-governmental institutions and farmers' organizations in irrigation management and correspondingly reducing the role of the state in irrigation management. Privatization may involve transfer of ownership of only system assets or, in the cases of Bangladesh and several African nations, it may also include the non-governmental provisioning of pumps, agricultural inputs and marketing services. Management turnover may involve the devolution to nongovernmental institutions of any of the following four management roles: 1) arranging or commissioning O&M services, 2) financial sponsorship for O&M, 3) performing O&M tasks themselves, or 4) regulating irrigation management.

Through privatization and turnover, many governments are pursuing the objectives of: 1) improving the management performance and sustainability of irrigation systems, 2) reducing the costs of O&M and 3) reallocating scarce revenues to more efficient or more inherently governmental purposes (such as regulating water use along river basins). Privatization and turnover policies are normally driven by two assumptions: 1) farmers are financially and organizationally ready to assume ownership and/or management; and 2) management turnover will improve the performance and sustainability of irrigation systems. Both assumptions are crucial, but they are largely undocumented.

Governments may transfer management and ownership of small systems (such as in Indonesia) or they may turn over distributary components of large-scale systems (such as in the Philippines, Mexico and Sri Lanka). Some countries are using a gradual, self-selected approach requiring local organizations to fulfill preparedness criteria prior to turnover (Sri Lanka, the Philippines). Others follow a more decisive, policy-driven approach (Nigeria, Indonesia, Senegal). In Colombia, irrigation service fees are based on actual O&M costs, calculated at the system level. After the actual costs of O&M are revealed in this manner,

farmer organizations which decide they can manage the systems better and less expensively are taking over the full management of the systems.

The privatization of irrigation equipment in Bangladesh has succeeded in promoting distribution of equipment and increasing the area under irrigation. However, it does not appear to be associated with significant improvements in tubewell capacity utilization or yield. Rather, privatization appears to be associated with greater inequality in the distribution of incomes, and further transfer of land from the poor to the rich through sales, mortgaging, and share-cropping of land.

Due to privatization of irrigation equipment and the accompanying changes in the management approaches of the irrigation and credit institutions in Bangladesh, a market for water has appeared. But there were different ramifications for productivity, efficiency and equity. The market for water has been aggressive in areas with a high water table due to both deep and shallow tubewells. A good example is the Tangail area. In low water table areas such as Gazipur, no such event has yet occurred. The manner of competition in the water market, however, is far from perfect and highly unequal due to irregular avenues to credit and the products market. This situation has created additional negligence in the manipulation of equipment and difference in the circulation of benefits.

The implication of these findings from research suggested the elimination of institutional rigidities and social inequalities so that the existing water market will be able to work more productively and with a more favorable impact on equity (Mandal, 1988:20-21).

Despite the widespread and simultaneous nature of this phenomenon, there is surprisingly little information available internationally about: 1) the different private-sector management models which have been used, 2) the different processes used for turning over management to nongovernmental entities and 3) the outcomes and impacts of these experiences. Governments are groping for ideas and information about the experiences of other countries in irrigation management devolution. Even without such information, many governments are going ahead with their own programs. Hence, there is an urgent need to document and disseminate information about the variety and results of nongovernmental management models and the turnover processes being used in various countries.

4.6 LOCAL USERS' INVESTMENT IS VITAL FOR THE INSTITUTIONAL DEVELOPMENT OF FMIS

There is a tendency for government agencies assisting FMIS to create public assets in the farmer community rather than to develop community assets in the community. By this we mean that governments design and build irrigation structures with government funds, without requiring even partial local investment. The result is that farmers perceive the structures as government property for the maintenance of which the government should take responsibility. Therefore the farmers do not maintain the structures well because they expect that the government will, or should, return sometime in the future to rehabilitate the system. This hampers the development of effective local

management of FMIS. Government assistance strategies should be aimed at stimulating local investment rather than supplanting it.

Some programs, such as the Village Subsidy Program in Indonesia, provide grants to villagers for the purchase of materials. The villagers decide how to use the funds and, provide all labor; other necessary materials are obtained at their own expense. For several years, irrigation has been one of the most common choices in the use of funds. In nearly all regions of the country, the value of the local investment stimulated by the partial outside investment has exceeded the outside assistance. Decision making on priorities and collective investment by local groups help engender a local collective sense of responsibility for the system.

According to Dayaratne and Moragoda (1991), a key factor for the success of the Village Tank Rehabilitation Program in Sri Lanka was that it maximized the use of local resources, particularly human resources, in the form of participatory manual labor in contrast to the use of heavy machinery by other intervention programs.

Local investment by farmers in FMIS is a key factor in the institutional development of FMIS and consists not only of investment in farmer labor and equity, but also of investment in indigenous technical knowledge, organized efforts to negotiate decisions among fellow farmers, creating and implementing rules and sanctions, and trial and error experience in designing and managing systems. Such physical and social forms of group investment are the bases for developing a local, collective sense of ownership, responsibility and organizational values for FMIS.

4.7 REHABILITATION OR IMPROVEMENT OF FMIS REQUIRES DIFFERENT DESIGN AND CONSTRUCTION PROCESSES AND CRITERIA THAN THOSE USED FOR AGENCY SYSTEMS

In agency-built and-managed systems, of which area tends to be larger than that of FMIS, design, operate, maintain and rehabilitate irrigation systems are done with little or no farmer participation and are based on standard engineering design and hydraulic criteria. However, for rehabilitation and physical improvement programs aimed at the FMIS sector, there is a strong need to develop irrigation design processes and sociotechnical design criteria which are substantially different from processes and criteria typically used for larger agency systems. Farmers' local knowledge, priorities, management objectives and capabilities must become the primary basis for developing locally appropriate improvements in FMIS, because it is the farmers themselves who must manage the systems entirely with their own resources.

For example, despite the tendency of agencies to place high priority on diversion structures, farmers in FMIS in hilly areas often prefer to invest in the conveyance network. As Bhattarai (1990:67) notes:

> Because the budget ceiling for improving the irrigation systems was low the farmers of most systems agreed to use the available money at places other than the diversion structure at the headworks. It is nearly

impossible to build permanent diversion structures on mountain streams with high silt loads....Except for one system where wire crates were used to improve the diversion farmers decided to continue using high labor inputs to rebuild the diversion when necessary using brush and stones.

In an assessment of rehabilitation of minor irrigation in Sri Lanka, Abeyratne (1990:56) has said that in order to integrate the technical and organizational aspects in irrigation rehabilitation, there is a need to involve farmers more effectively than at present in all phases of the rehabilitation process. This is not just to support the rhetoric on farmer participation but to help it emerge legitimate and recommendable in the long term. In the design of the irrigation structures, it is worthwhile to combine the necessities or regulations of the farming group. Decision-makers and planners have realized it and therefore encourage the suggestions of farmer groups.

At the FMIS Workshop on Design Issues in FMIS (in Chiang Mai, Thailand, 1989), workshop presentations highlighted a number of cases in which the use of local knowledge and experience allowed for improved farmer operation and maintenance of the system with a lower cost for the improvements. There was also documentation of cases where local knowledge and experience were not used, often resulting in structures that were unused or altered by the farmers. The farmers' criteria were identified as important considerations for achieving a good outcome that would support operation and maintenance by the water users. During the data collection and design process, both the data and the agency's criteria need to be tested against the farmers' criteria. The experiences shared by the workshop participants highlighted the fact that the priorities of agency and farmers are often not the same, and that repeated interaction is necessary to reconcile the two (FMIS Newsletter No.7, 1990:12) .

4.8 SUCCESSFUL MANAGEMENT IMPROVEMENT OF FMIS DEPENDS ON CLARITY ABOUT RIGHTS, RESPONSIBILITIES AND OBJECTIVES

Government assistance to FMIS should be provided only where water use rights, responsibilities, performance objectives and system boundaries are clear, or where they will be made clear under the assistance program. The assistance program should not be initiated prior to there being clear agreements about the effects the assistance will have upon the rights and responsibilities of the water users (See WECS & IIMI, 1990). The farmers who are responsible for following rules and regulations for FMIS management must largely be the same ones who create, adopt or change the rules. Rules are normally ineffective when they are imposed on irrigators by external agencies or absentee landlords. And development of effective FMIS institutions depends on there being a proportional and direct relationship between farmer investment responsibilities and water use rights. Local management solutions to the problem of the "free rider" must be found, so that non-payers (i.e., those who do not pay water fees or do not join group maintenance activities) will not reap the same benefits that payers or full participants do. Ostrom (1990a and 1990b) has shown the importance of group invention of locally relevant rights and responsibilities and of effective sanctions against free riders before irrigation institutions can become viable.

As Pradhan notes about FMIS in Nepal, water is traditionally recognized by farmers as a community resource. In farmer-managed systems, water is conceived as a community resource owned by the group. The acquisition of water is a community effort. Hence, the principle of water allocation and water distribution is determined by the community as a whole. The community allocates water to individuals and the allocation principle is to be observed by all (Pradhan, 1989:70).

In the early society, where farmer-managed systems were established, farmers's rights were guaranteed by their members. But now with the advent of other users including the Irrigation Department, FMIS are faced with insecure circumstances regarding their water rights (Korten 1985). With the state intervention from the Irrigation Department there may be some complications for the existing water users. It seems that one impact of state intervention is the disruption of security of water rights held by traditional users (Pradhan 1984).

According to Coward and Levine (1987:19), state intervention does not normally guarantee water rights though it improves the control of the system. Because of this, there is a possibility for uncertainty about water rights to increase thus allowing a negative impact on the legitimacy of the FMIS. Because irrigation agencies do not have a defined limit to acceptable action, this uncertainty about water rights can lead to undesirable policies and actions by the irrigation agencies.

In most traditional small-scale irrigation schemes in the developing countries, farmers have spent more time on water allocation and land allocation. Even traditional rules and principles are also related to a set of land and water rights identified and practiced by the users of the irrigation system.

Where land and water are scarce, the allocation is complex (e.g., in arid zones). According to these conditions, farmers are expecting many remarkable changes in water and land regulations and practices of allocation of these resources. However, the present situation of land and water rights was identified as a problematic area and political and legal moves have to be taken to defend these rights.

The World Bank, other development agencies, and the developing countries themselves, are involved in rehabilitating or otherwise improving existing irrigation schemes. In these cases, it is essential that planners and project officials understand and take into account the already existing patterns of land and water rights, and the established procedures for operation of the scheme. An appreciation of these rights and procedures can, and should, influence many aspects of project design, including 1) layout of the irrigation water distribution network, 2) water management practices (especially scheduling of water issues), 3) anticipated cropping patterns, and 4) estimated incidence of project benefits among scheme participants. The pre-existing system of property rights helps to define the physical and socioeconomic limits of change under the project, by bounding the set of socially-acceptable arrangements for layout, water scheduling, etc. The pre-existing system is a reality that must be analytically decomposed, if planners are to make accurate predictions of the outcomes of project interventions (Hecht, 1988:1).

4.9 GOVERNMENT EFFORTS AT INSTITUTIONAL DEVELOPMENT OF FMIS SHOULD BE BASED NOT ON STANDARD MODELS BUT ON LOCAL MANAGEMENT NEEDS

The external imposition of standardized institutional structures and training packages is not effective in developing viable FMIS. Therefore, agencies which are oriented toward applying bureaucratic solutions, often attempt to assist FMIS through their formal establishment according to standard organizational models. Training programs for farmer leaders often emphasize either consciousness-raising about general values or else about standard organizational skills. Often, what the farmers are more interested in are their own functional management problems and how to address them. To encourage local institutional development, agencies should give less attention to standardized institutional models and training modules and more attention to helping FMIS clarify their own management objectives and functional management requirements.

Bandara (1990:17) has observed that in Sri Lanka, the management of small irrigation tanks was traditionally the responsibility of village leaders. But as the local, traditional leadership structure has been dismantled by government intervention and changing government policy, a leadership vacuum for tank irrigation has often resulted.

Jungeling (1989:46-47) asserts that in Sri Lanka, formal regulations expounded in the cultivation meeting are frequently obstacles to self-reliance on the part of the water users. Regulations are often at odds with the decision-making processes of water users in minor irrigation systems. Following standard arrangements introduced by the government which are often at odds with local interests are the formal duties of the farmer representative with his fixed remuneration, water users being defined as registered (owner) cultivators only; the way maintenance is organized through the share list and the *shramadanas* (provided there is a real objective to support the development of self-reliant minor irrigation management) is also the responsibility of the farmer representative. The effects of these regulations differ between systems, partly depending on the way these are received by the water users.

Dayaratne (1991:58) notes that farmers' mobilization in blueprint-type World Bank and ADB funded programs is very poor resulting in little farmer participation throughout the process. The rigidity of the "blueprints" in such programs as the *VIRP*, the Kurunegala *IRDP* and *ADZAP* has failed to place the farmer first. Some of these strategies have made unsuccessful attempts to mobilize farmers at the latter part of the project; these have proved impracticable. The *wew-sabha* system of farmer organization has been introduced to the tank-based communities as a top-down imposition and as a "prototype" forum, rather than being the natural outcome of farmers' spontaneous efforts (bottom-up), resulting in inefficient and/or malfunctioning *wew-sabhas* comprising very small farmer groups (e.g., three to six farmers in one *wew-sabha*).

In one more flexible program in Sri Lanka, the Agricultural Planning Team allowed the water users to develop their irrigation management capabilities during the preconstruction and construction stages of the program. The entire process took 12 to 18 months. The Agricultural Planning Team identified the farmers who were dedicated and who could become leaders. In many pilot areas, formal water users' associations were eventually formed, each within differing periods of time, after their roles and tasks had been clearly identified by the farmers. The Agricultural Planning Team modified and adjusted rigid procedures to enable the organizations to evolve, each in their own time and way. (Medagama, 1990:113)

Dani & Siddiqi (1989:85) point out that in irrigation, what is more valuable about existing organizations is that they already have procedures for decision making, patterns of communication, and means for building consensus and resolving conflicts; capabilities that invariably take some time to develop under the best of conditions. Agency interventions which ignore this and annex existing irrigation systems within an external management structure tend to alienate local groups from the hydraulic property they have created or acquired.

The attempt to improve existing organizations has to be ensured with continuity with the past. This is the obvious lesson of public interventions. However, it may be easier to sustain this continuity in the long term.

To fit in with the especial environment of each irrigation system, IIMI has evaluated a range of institutions - organizations, rights, water-allocation principles, water-distribution practices, and procedures for conflict management -- of the FMIS in Nepal with close collaboration of the government. The first task in this evaluation in providing assistance was to accurately understand and measure the strengths and the necessity for these institutions. Due to environmental variations and variation of personal preferences, the necessary institutions for effective irrigation do not lend themselves to a blueprint approach that once developed can be shifted and duplicated in each new setting. To fit in with the local institutions and physical needs in each system, assistance must be tailored.

To improve their physical irrigation infrastructure and management practices, assistance was provided to the farmers. The compulsory conditions were user participation in the identification of issues, setting priorities for physical development and the implementation of the assistance program. Among the many positive results brought about by user participation was the operation and maintenance of the systems on their own (WECS & IIMI. 1990:4).

4.10 THERE IS AN IMPORTANT NICHE IN FMIS DEVELOPMENT WHICH CAN OFTEN BE EFFECTIVELY FILLED BY NONGOVERNMENTAL ORGANIZATIONS

In recent years, nongovernmental organizations have become increasingly involved in assisting FMIS, especially in the institutional development aspects. There have been numerous examples where such nongovernmental entities as social organizers and farmer-to-farmer exchange training strategies have proven so successful that by the mid-1980s they had shifted from being only pilot projects to parts of national programs.

Increasingly, NGOs are taking over the management of irrigation systems and turning it over to local groups. The Grameen Bank in Bangladesh has been purchasing public tubewells and selling them on credit to local voluntary groups of landless men and women. The Bank provides management training and guidance in how to take over full ownership and become profit-making. Against the backdrop of the failures of the collective management of irrigation tubewells by landless groups, the Grameen Bank staff took up direct management of deep tubewells (DTWs) in 1987. In the central district of Tangail, the Grameen Bank has so far bought about 100 DTWs, and these are now being managed by its own staff on a commercial basis. The bank has also started similar management programs with about 2,000 old and new DTWs in the Rajshahi Barind Tracts and in Dinajpur District in the northern parts of the country which it has purchased.

A one-fourth share of the crop is usually charged for water cost, but when seeds, fertilizers, and insecticides are also provided along with the water, one-third of the crop is charged. The management of deep tubewells (DTWs) is divided into three distinct stages. The first stage involves activities such as the construction of drains for water conveyance, making agreements with farmers for providing irrigation water, repairing engines, and building a stock of diesel and spare parts. In the second stage, the bank workers advise farmers to raise seedlings, puddle land, transplant seedlings, and apply fertilizers. The final stage involves the collection of the share of the harvested rough rice from the fields and arranging for threshing, drying, disposal and storing of the rice.

Most DTWs that were purchased by the bank had been out of operation for a number of years, and therefore running of those tubewells for rice production brought about farmers' confidence and trust in the management of the Grameen Bank. Many of the tubewells had also low command areas and yields in the initial year, because the bank staff had no previous experience of irrigation management and most farmers were not familiar with irrigated cultivation of *boro* rice. One-fourth sharecropping exists as a dominant mode of payment for water charged by the private as well as the cooperative water sellers, but the accumulations from water selling in the case of the Grameen Bank will benefit its landless shareholders only indirectly, through wage employment and dividends (FMIS Newsletter No.8, 1990:12-13).

In the Gujarat State in India, with the assistance of local NGOs, very poor tribal farmers improved their irrigation productivity. Bhil tribe inhabited Panchmahal district's farmers organized themselves to create and manage common factors to meet the high cost of lift irrigation with the assistance of the Sadguru Water and Development Foundation (Singh, 1988:21-26).

The package provided by the Foundation includes assistance in finance, accounting and book keeping, maintenance of pumps and machines, billing and recoveries of dues, and agricultural extension. Responsibility of system management has been transferred to village cooperative societies since 1982-83. The Management Committee which is responsible for the employment of workers to perform activities, was elected by the Lift Irrigation Cooperative Society. The main objective of this was to make the village independent of the parent organization. In the future they can manage systems by themselves.

In the program success areas where lift irrigation is functioning, tribal people have taken up irrigated agriculture. Farmers have been able to pay irrigation fees and have contributed to the initial fund. One of the single most important criteria for improving performance is the group approach which they have developed in the system.

In the initial years, the Foundation established and managed lift irrigation schemes with help from the farmers. This arrangement continued until 1982-83, when the first cooperative society was formed. Thereafter all schemes have been converted into cooperative societies and new schemes have been started as cooperative ventures.

Social organizers, as mediators between farmers and agencies, have often been successful in facilitating both effective farmer participation in assistance programs and viable local institutions to manage FMIS. At first, in the 1970s and early 1980s they were successful in pilot action research and development projects, especially in the Philippines, Indonesia, Thailand, Nepal and Sri Lanka. They were usually non-civil servants with some higher training, especially in the social sciences. They helped organize farmers into water users' associations, involve farmers meaningfully in rehabilitation or other physical construction, and help them develop effective O&M work programs. The use of social organizers in the Philippines in the programs to assist communal irrigation has proven to have much better results, in terms of productivity, area irrigated, and viability of water users' associations, than in systems where social organizers were not used (See de los Reyes & Jopillo, 1986).

Even social organizers not directly engaged in projects with rice farmers have helped in some places in Sri Lanka to organize small farmers to deal with their problems. For example, in Suriyawewa (North Hambantota) small groups of chena (slash-and-burn) farmers have been organized to rehabilitate tanks and to adopt improved farming practices (Dayaratne, 1990:103).

Many alternative approaches to increasing farmer participation through the use of social organizers are possible, depending upon the particular conditions in a specific country. The social organizer could be one person, or a team with a role developed and implemented under a single agency. Increasing the use of social organizers could also be accomplished through the trilateral coordination efforts of research institutes, the irrigation department and the farmers.

There is a need for flexibility in the implementation of social organizer programs to ensure the sustainability of their role and participatory approach. After the withdrawal of the social organizer and within a certain time frame, the performance of the water users' groups in management and maintenance should be monitored to measure sustainability (FMIS Newsletter No. 7, 1990:9,10).

In 1989, IIMI sponsored a Workshop on the Use of Social Organizers in Irrigation, held in Khon Kaen, Thailand. Two types of social organizers were identified in the course of discussions in the Workshop. One type is the single-purpose social organizer who deals exclusively with irrigation-related activities. The second type of social organizer is the multipurpose organizer such as the "group organizer" in Nepal. The effectiveness of the type of social organizer fielded would depend on the institutional and social environment. Hence, the choice of the type of social organizers should be evaluated within the relevant environmental contexts in which they work.

The tasks of social organizers referred to most frequently in the Workshop on Social Organizers are project identification, information collection, mobilization of farmers' ideas in design, and the motivation of farmers to carry out activities in construction and in the establishment of water users' associations. The social organizer seems to play a key role in catalyzing a process in which communication lines are kept open between all parties.

The experience of being an institutional organizer appears to be positive in helping the irrigation inspectors discover the value of farmer experience and knowledge and the importance of social factors related to irrigation. Many inspectors hear for the first time the farmers' rationale for choosing a certain type of structure that is needed and not another. For example, they discover that farmers can tell them exactly what type of lining is needed and where. The farmers know this by experiencing relative degrees of water loss under different levels of water discharge through the channel. The institutional organizer realizes that this is knowledge which is not ascertainable by a conventional technical survey. The institutional organizer also learns that farmers request simple structures, such as lining, only where they are really needed so as to spread out and better use the limited funds available.

Institutional organizers who, fortunately, consulted farmers are also receiving proposals from them; this would not be perceived as a need by an inspector who does not wish to consult farmers. For example, farmers know they need more sediment-flushing gates because of the amount of labor required to clean out the channels. Also the tendency of the proposals to emphasize the conveyance system as opposed to the diversion structures (which tend to be emphasized by the agency) makes the institutional organizer more sensitive to designing for farmer-management needs.

Through information gathered in the "sociotechnical profile" the institutional organizer learns that although there may not be an active and functioning official water users' association, numerous management tasks are being accomplished by the users through informal or traditional mechanisms. Seeing the extent of current farmer-management practices, the institutional organizer discusses with the farmers their complete takeover of operation and maintenance, and repair work after turnover.

The case of traditional irrigation schemes in South Sumatra has shown that community organizers fill an important function in facilitating farmer participation at every stage of the process. Farmers have the will and the potential to participate; the role of the community organizer is to stimulate and to accelerate the participatory process (Manor, Sanguan, Olin., 1989:2,6,39 & 47).

Another recent, innovative strategy for developing effective local institutions to manage FMIS is the use of farmer-to-farmer exchanges and training activities. These are low-cost interactions between FMIS where farmers learn directly from their more effective or experienced counterparts.

Some FMIS in Nepal were well-managed and others were not. Examinations of these revealed the reasons for this and how the concept of farmer-to-farmer training originated. Even though, some systems had much better physical infrastructure, they had poor performance. The system with well-performance however, led to the suggestion that management improvement could enhance system performance. Farmers of poorly performing systems were provided with an opportunity to see and hear about other systems which performed well. They got an occasion to see in detail the practices and effort needed to make a system well-perform. They also observed the management changes (WECS & IIMI, 1990).

This idea is based on the upward-downward correlation using farmers as trainers. It seems that communication between farmers groups is an effective method. It is understood that the field experiences as well as communication with each other at the same time will have a higher possibility of success. When farmers visit several systems they may be able to do a comparison between well-managed and poorly-managed systems. With the assistance of facilities farmers can analyze the reasons for differences and what would be applicable for their own system. When the trainers return home, they can apply the knowledge they gathered from their visits, to overcome their own problems.

4.11 THERE IS A WIDESPREAD AND IMMEDIATE NEED FOR GOVERNMENTS TO SYSTEMATIZE INFORMATION AND PLANNING FOR THE FMIS SECTOR

There is a strong need in many countries to develop effective programs and organizational arrangements for assisting their FMIS sectors. The key needs are for the development of systematic methods for inventorying FMIS (assembling basic information about their numbers, locations, area served and key physical structures), conducting rapid and periodic appraisal of FMIS problems and needs, information management systems for enabling timely and informed decisions, methods of prioritizing use of scarce funds and arrangements for joint agency/local investment in FMIS.

Research in FMIS under varying environments has identified that physical and organizational improvement must go together for a system to achieve its production potential. It has also identified management techniques and organizing principles which can be adopted by farmer-managed systems and farmer organizations in agency-managed systems (Pradhan & Yoder. 1989:1).

Rapid-appraisal techniques can be employed to gather information necessary for project preparation and also to disseminate information about procedures to the farmers. The rapid appraisal must be designed to collect relevant data for making all decisions concerning assistance, including the capacity of the farmers' organization to manage the assistance inputs or the training support it requires for the following: making decisions, maintaining accounts and labor records, establishing working relationships with outside systems on water rights, and determining water allocation among users. Information on decisions regarding possibilities for expanding the users' group and identification of the approximate level of material and financial support required for physical improvements must also be considered.

A comprehensive irrigation resource inventory that involves the water and land resource utilization of each irrigation system within a river basin would allow ready identification of schemes where assistance will: 1) allow expansion of the irrigated area, 2) allow increased cropping intensity on the existing irrigated area, and 3) show where O&M costs can be reduced, making a system economically more viable.

Assistance for improvement of only the high-priority items in the farmers' long list of wishes and needs is cost-effective, makes precise estimation of the amount of assistance needed less important, and strengthens the users' organization by encouraging them to contribute their own resources. Although it was not intentional that the Water and Energy Commission Secretariat's action-research project could not totally fund all improvement work in each system assisted, it proved to be valuable in encouraging the farmers to make efficient use of what they in fact received (WECS & IIMI. 1990:36,6,4).

In the Philippines and Indonesia social scientists and engineers have developed instruments for making assessments about the problems and needs of FMIS, as well as of jointly managed systems. Such methods are called system inventories (if they are brief) or sociotechnical profiles (if they are more complete). The methods involved semi-structured guides to observe the existing physical situation (canals, structures, crops) and to interview key informants about the historical development of irrigation, use of the water source between systems, farmers' priorities on how to use government assistance, organizations and leaders in the areas involved in irrigation, and agricultural practices and performance. The product is a profile about the system to assist the government decision maker to plan assistance to the system, or to plan assistance among a regional set of systems (Korten, 1989:299).

Rapid rural appraisal is a method increasingly applied in irrigation management and in the FMIS, not only by researchers but by agency personnel as well. This appraisal provides a method whereby agencies are better able to obtain information from the field on management problems and farmers' perspectives in sample locations. The uses of rapid assessments are varied and flexible. Rapid assessments provide qualitative insights from which routine statistical data take on new meaning. They can provide timely information to assist agencies to make decisions based on better qualitative understanding of irrigation management (Groenfeldt, 1989: 21). Rapid appraisals have also been used in preparatory stages of the design process to ascertain farmer priorities and basic structural needs (WECS & IIMI, 1990).

4.12 KEY CONSTRAINTS TO EFFECTIVE STRATEGIES FOR ASSISTING FMIS EXIST WITHIN BUREAUCRACIES

There is a need to analyze the various constraints which exist within bureaucracies for interacting with FMIS in ways which are sensitive to local needs and capacities. These include constraints which work against the needs for flexibility in timing, sensitivity to local priorities and capacities, openness about budgets and joint agency/farmer investment [see WECS & IIMI, 1990) Acharya (1990) and Bhattarai (1990)]. For such analyses, the willingness of agencies to open their system-level accounts for farmer inspection is of considerable importance.

Often, agencies are constrained from adapting flexibly to availability of local labor by budget or contract deadlines. Rigid "quality control" or design standards impose emphasis on structures which may not be important to farmers. For example in Indonesia, agency assistance to FMIS often involves a "lowland" bias toward diversion and division structures, while farmers in hilly FMIS areas often place higher priority on strengthening conveyance canals through unstable hillsides. Government budgetary restrictions, used in the name of accountability and control, often make joint investment or openness with farmers about budgets impossible. Adjustments need to be made at ministerial levels in line with finance ministries.

5. IMPACT OF THE FMIS PROGRAM

The FMIS program has been in operation only for a period of three years, which is a short time span to evaluate the impact of such a program. Therefore, IIMI has not yet carried out a formal evaluation of the impact of the program. Furthermore, as there are other actors in the field of FMIS, it is rather difficult to fully identify the direct impacts of, and the changes made because of the FMIS program. However, an attempt is made here to illustrate a number of beneficial effects and advantages of this program.

One of the objectives of the FMIS program is to generate interest in FMIS topics among professionals and policymakers and to stimulate activities in FMIS. The FMIS Network, which has drawn the attention of many irrigation professionals to the potential of FMIS in various parts of the world, is a growing network. The mailing list of the FMIS Newsletter reflects this interest. The mailing list, which is being revised continuously, includes all those who wish to receive the FMIS Newsletter as well as other publications and information on FMIS. The list has grown from 150 members in 1988 to 1200 members in 1991. More details of the expansion during the past three years are given in Annex B.

The expansion of the Network outside the Asian region was a result of key professionals participating in the Network activities. About 25 percent of the total membership is taking an active part in the Network through the exchange of information and experiences. As the membership increased significantly, more and more professionals from Africa and Latin America have joined the Network. The Network spread to Africa and Latin America as a direct result of people from these two continents taking part in its activities. As a result, more attention was given to initiating FMIS programs in African countries like Egypt, Sudan, Morocco and Nigeria. In Latin America, the FMIS Network has already made significant progress in Argentina in creating awareness of the importance of FMIS among the various institutions in the country. A variety of FMIS support activities have been initiated. The proposed Workshop on Performance Measurement of FMIS, which will be hosted by the Argentinean Network members, will be an important step in strengthening the program in Latin America. The activities in Argentina have stimulated interest among the neighboring countries such as Chile, Brazil and in particular Peru, presenting new opportunities for the exchange of information and experiences with Latin American countries. The experiences in traditional FMIS of countries such as Chile or Peru can make an important contribution to the development of FMIS in other parts of the world.

Recently, professionals from China have indicated a strong interest in FMIS Network activities, which is an encouraging development. While it may be true that size of the network, in terms of numbers, may not accurately reflect the impact of the FMIS program, it is reasonable to assume that if more professionals from a wide range of disciplines are involved there will be more opportunities to diversify the range of interventions in FMIS through research programs, policy changes, new ideas and plans, and their implementation.

Furthermore, in Thailand, the Royal Irrigation Department (RID) has realized the importance of farmers' experience and knowledge in the rehabilitation of FMIS and, as a result, it has changed its approach which had previously been mostly technically oriented. An associated national network, TRIMNET, has played an important role in facilitating this change. In Sri Lanka the experience gained in FMIS is having an impact on the preparation of new irrigation management policies. As a result of lessons learned through various media, including IIMI's FMIS and other programs, the next major FMIS rehabilitation project will be focussed on institution-building, and recently the government has been discussing a policy objective of turning more schemes over to farmers for self-management. Similarly, in Bhutan, the results of activities carried out on FMIS are an important input for framing a new irrigation policy. In Nepal, an action-research program was conducted to examine strategies for assisting existing FMIS. The lessons learned from this program have wide applicability for increasing farmer participation and responsibility in irrigation management. In the Philippines the emphasis has been on translating major findings into intervention strategies and detailed implementation schedules.

The FMIS Network has also received requests from members asking for support in the development of national networks in their countries or for collaboration in their programs. Recently, members from Tanzania and Peru have requested IIMI's collaboration in their FMIS programs.

The involvement of government and agency officials in FMIS workshops and in other activities of the FMIS program has, in some cases, a direct effect on government strategies. If they are directly involved in the FMIS network and are in a position to influence changes in their own country, then there is an opportunity for direct implementation of new ideas or approaches. For example, in Sri Lanka a government official who has actively participated in the Workshop on the Role of Social Organizers in assisting FMIS has succeeded in getting some of the recommendations made at the Workshop implemented. As a result, in a new program in Sri Lanka, about 250 social organizers will be recruited to help farmers to get organized and improve the irrigation-management performance in FMIS. Similarly, other participants of this particular Workshop from Indonesia and the Philippines have contributed to improving FMIS in their own countries: a Farmer Irrigation Organizing Project has been formulated in the Philippines, and a program to use trained agency staff as social organizers in the turnover program has been developed in Indonesia.

The need for training in FMIS has been highlighted at FMIS Workshops and at Advisory Committee meetings and also by several Network members. Those requests have encouraged several institutions to initiate activities in training independently or in collaboration with IIMI. For example the German Foundation for International Development (DSE) is planning a training program on FMIS for South East Asian participants this year. Furthermore, a curriculum for a training program in FMIS in sub-Saharan Africa has been jointly developed by Wageningen University, Silsoe College, and the University of Southampton.

Dissemination of knowledge to network members and other interested audiences through publications is another way of sharing knowledge and research findings. Although some of the publications are country-specific, there is still an indication of high interest in them and there were several requests for additional copies of these publications to be used for training programs and libraries. One way of evaluating the impact of such publications is through the responses received from network members. They show a high interest in the contents of these publications.

See Annex C for a sample of the varied responses to the FMIS Network from around the world.

6. PRIORITIES FOR FUTURE RESEARCH AND DEVELOPMENT

Phase I has proved that the FMIS Network provides an excellent framework for the mobilization of additional resources, particularly in relation to activities such as workshops, training, study tours and the publications of research topics and workshop proceedings.

Phase II of the FMIS program will continue the work of creating awareness among researchers, professionals , donor agencies and government officials of the potential role of FMIS in irrigated agriculture and developing and implementing more appropriate and effective support to FMIS.

More specifically, building on Phase I achievements, the second phase will concentrate on the following directions:

6.1. Implementation of selected lessons learned so far in FMIS. There is a considerable amount of knowledge accumulated in this field which can contribute to the improvement of the overall performance of irrigation systems. Translation of findings into intervention strategies and detailed implementation schedules is an important goal. This approach is being implemented now in the Philippines and can serve as a model for other environments. Through the Network, we plan to encourage this kind of approach and disseminate information about experiences gained. This will include training programs and development of improved systems of support services for different conditions and different irrigation environments, based on successful cases. Topics of particular priority are performance-related assistance strategies, management turnover and how to facilitate and stimulate local resource mobilization.

6.2. Most of the Network activities and the research program in Phase I were concentrated in Asian countries. In Phase II the program will include additional countries from Asia such as China, and countries from Africa and Latin America. This will enable the sharing of experiences gained in the past with the new countries and will provide an opportunity to learn from their experiences and expertise offered. The Newsletter will continue to be the major link for network members and portions of it will be published in Spanish and French. A series of workshops on critical issues affecting FMIS at global, regional and national levels is planned. They will be oriented towards gathering information and analyzing experiences on selected topics, with the aim of promoting and disseminating approaches and solutions. The following workshops are planned for the period 1991-1993.

* *Performance Measurement of FMIS (to be held in November 1991 in Mendoza, Argentina)*: Measurements of performance are an essential foundation for other categories of investigation of irrigation systems and their modes of organization. Performance measurement involves the analysis of system goals, selection of measurable indicators of the degree of achievement of these goals, and methodologies for practical monitoring of these indicators. Much activity is currently underway on this subject. This needs to be adapted and extended in ways appropriate to FMIS. The Workshop will review concepts, methodologies and case studies of actual performance.

* *Workshop on Turnover (planned for 1992)*: Operation and maintenance (O&M) are the weakest parts of government-sponsored irrigation systems. Ineffective O & M has resulted in severe deterioration of systems. When systems reach intolerable limits pressures are exerted and the systems are rehabilitated at high costs. In comparison to the agency-managed irrigation systems, systems developed and managed by water users are often found to be more cost-effective. In addition, their O&M costs are usually lower. Given these realities, many agencies throughout the third world have realized the need to turn over the management of small-and medium-scale irrigation schemes to water users. It is hoped that this will make the systems more responsive to users' needs and also reduce O&M costs for the agency. It is well-understood however, that turnover is a complex process involving difficult issues that will be discussed in the Workshop.

* *Workshop on Resource Mobilization in FMIS (planned for 1993)*: There is great potential for the beneficial use of farmers' accumulated knowledge in managing and improving FMIS. This knowledge has been time-proven and is usually compatible with the farmers' ecosystem. This potential should be used to increase the effectiveness of FMIS. This could be accomplished through a multi-step process that will be initiated by an international workshop. One task, among others, that participants of this Workshop will undertake is the compilation of available lessons on farmer-to-farmer extension activities from various countries. Additionally, the participants will attempt to derive common lessons and assess the potential for resource mobilization which can be disseminated to national agencies. Participants will include researchers and national agency officials with backgrounds in extension work.

* During the three-year period from 1991 to 1993, the FMIS Program intends to hold two regional workshops. The first, slated for early 1992, will deal with organizational issues in lift irrigation, a topic of particular interest to Bangladesh, Pakistan and India, although experiences from other countries will also be represented. The topic for the second workshop will be on conducting Inventories of FMIS.

Through the network, IIMI will also provide technical assistance to the organizers of national workshops on topics of local concern.

6.3. Research programs will concentrate on:

(a) **Performance-Oriented Assistance Strategies for FMIS**: As many FMIS do not perform to their full potential there is a need to identify the areas in which they fall short. It is therefore important to measure and evaluate their level of performance objectively and to identify specific areas in need of improvement. Assistance Strategies should be based on local performance objectives and constraints and on stimulating local capabilities to improve and manage systems. Performance is also the topic of the first international workshop planned as part of the network activity in 1991.

(b) **FMIS Groundwater Management:** Much of the FMIS activities of IIMI and the FMIS Network to date have concentrated on surface irrigation systems. In areas such as Bangladesh and West Bengal, groundwater lift irrigation is becoming increasingly important in terms of both number of tubewells and the area irrigated. The research plan is to focus on the access the poor and the landless have to groundwater irrigation technologies appropriate to the needs of small and marginal farmers. Other research areas will include comparative tubewell operation under different management systems, turnover of government controlled tubewells to private management, and the impact of the privatization of tubewells on production and equity. The issue of ground water is the topic of a regional workshop to be held in 1992.

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Annexure A

LIST OF PUBLICATIONS ON FMIS

a. **Funded by the IFAD/BMZ grant or with financial support from the Ford Foundation (FF), the United Nations Development Programme (UNDP), the International Development Research Centre (IDRC) and the Caisse Centrale de Cooperation Economique (CCCE).**

Published

1. Irrigation Development in Bhutan: Prachanda Pradhan. 1989. (Working Paper No: 13).

2. Bibliography on Small-Scale Irrigation Systems in Sri Lanka. K.P. Vimaladharma. 1989.

3. Guidelines for Rapid Assessment of Minor Irrigation Systems in Sri Lanka. David Groenfeldt. 1989. (Working Paper No: 14).

4. Rehabilitation of Small-Scale Irrigation in Sri Lanka: State Policy and Practice in two systems. S. Aberatne. 1990. (Country Paper - Sri Lanka No: 6).

5. Improving Management of Small-Scale Irrigation Systems: A Possible Field of Assistance for Non-Government Organizations: Experiences from Hambantota District, Sri Lanka. Inge Jungling. 1989. (Country Paper -Sri Lanka No: 5).

6. The Role of Non-Governmental Organizations in the improvement of Minor Irrigation Systems in Sri Lanka. Workshop Proceedings: M.H.S. Dayaratne and G. Wickramasinghe. 1989 (Working Paper No: 18).

7. A Rapid Assessment Survey of the Irrigation Component of the Anuradhapura Dry Zone Agricultural Project (ADZAP): R. Ekanayake, W.M.U. Navaratne and David Groenfeldt. 1990. (Working Paper No: 16).

8. Role of Social Organizers in Assisting Farmer-Managed Irrigation Systems. Proceedings of a Regional Workshop of the Farmer-Managed Irrigation Systems Network held at Khon Kaen, Thailand from 15 to 20 May 1989.

9. Design Issues in Farmer-Managed Irrigation Systems. Proceedings of an International Workshop of the Farmer-Managed Irrigation Systems Network held at Chiang Mai, Thailand from 12 to 15 December 1989.

10. A Review if Alternative Strategies for Improving Farmer-Managed Irrigation Systems in Sri Lanka. M.H.S. Dayaratne. 1991. (Country Paper-Sri Lanka No: 7).

11. FMIS Newsletter - 8 Issues

Under Production

12. Strategies for Developing and Improving Farmer Managed Irrigation Systems, Rabat - May 1990 - Workshop proceedings.

13. An Assessment of the Village Tank Rehabilitation Program of the FFHC in Anuradhaphura: M.H.S. Dayaratne and R. Moragoda. 1991. (Proposed Working Paper No: 20)

14. FMIS Newsletter - No: 9

Plan for Publication

15. FMIS Rehabilitation in Morocco.

16. FMIS Rehabilitation in Chitral, Pakistan.

17. FMIS Rehabilitation in PIP, Thailand.

b. These publications were not funded by the IFAD/BMF grant but are a result of FMIS Network and its research activities.

1. Public Intervention in Farmer-Managed Irrigation Systems - Workshop proceedings: E. Martin and R. Yoder. 1989.

2. Irrigation Management in Nepal: Research Papers from a National Seminar: 1987.

3. Strategies for Improving Minor Irrigation System in Sri Lanka: David Groenfeldt, J. Alwis and J. Perera. 1987 (Working Paper No. 6)

4. Improving Irrigation System Management Through Farmer-to-Farmer Training: - Example from Nepal. Naresh C. Pradhan and R. Yoder. 1989. (Working Paper No: 12).

5. Patterns of Irrigation Organization in Nepal. A Comparative Study of 21 Farmer-Managed Irrigation Systems: Prachanda Pradhan. 1989. (Country Paper -Nepal No: 1).

6. Increasing Agricultural Production in Nepal. Role of Low-cost Irrigation Development Through Farmer Participation: Prachanda Pradhan. 1989 (Country Paper - Nepal No: 2).

7. Irrigation Management in Pakistan Mountain Environments: E.J.V. Vander Velde. 1989 (Pakistan Country Paper No: 3).

8. Fair and Unfair: A study into the Bethma System in two Sri Lankan Village Irrigation Systems: Ijsbrand H. De Jong. 1989. (Working Paper No: 15).

Annexure B

THE FMIS NETWORK MAILING LIST

a. Geographical distribution in 1991

b. Expansion of the Network - 1989 to 1991

a.

	AFRICA		ASIA		LATIN AMERICA & CARIBBEAN		OTHERS	
	Countries	Members	Countries	Members	Countries	Members	Countries	Members
Total:	23	135	16	506	23	338	14	255
	Algeria	1	Bangladesh	38	Argentina	53	Australia	8
	Benin	1	Bhutan	11	Barbados	1	Belgium	4
	Botswana	2	China	10	Bolivia	13	Canada	2
	Burkina Faso	6	India	86	Brazil	51	Denmark	1
	Egypt	2	Indonesia	71	Chile	47	F.R. Germany	6
	Ethiopia	6	Israel	20	Colombia	17	France	15
	Ivory Coast	1	Japan	3	Costa Rica	6	Italy	11
	Kenya	15	Laos	4	Cuba	6	Netherlands	21
	Madagascar	5	Malaysia	4	Dominican Rep.	8	Portugal	3
	Malawi	2	Nepal	62	Ecuador	14	Spain	2
	Mali	2	Pakistan	18	El Salvador	6	Sweden	2
	Morocco	30	Philippines	32	Guatemala	2	Switzerland	5
	Mozambique	3	Sri Lanka	80	Haiti	1	U.S.A	79
	Niger	1	Thailand	65	Honduras	2	U.K	96
	Nigeria	6	Vietnam	2	Jamaica	3		
	Senegal	14			Mexico	21		
	Sudan	7			Nicaragua	3		
	Syria	2			Panama	6		
	Tanzania	16			Paraguay	2		
	Uganda	2			Peru	53		
	Zambia	3			Trinidad/Tobago	1		
	Zimbabwe	8			Uruguay	7		
					Venezuela	15		

b.

	AFRICA		ASIA		LATIN AMERICA & CARIBBEAN		OTHERS		TOTAL	
	Countries	Members	Countries	Members	Countries	Members	Countries	Members	Countries	Members
1989	13	52	15	237	4	6	13	103	45	398
1990	19	100	15	330	11	29	13	198	58	657
1991	23	135	16	506	23	338	14	255	76	1234

Annexure C

FEEDBACK FROM NETWORK MEMBERS

The following are some extracts of the feedback from network members on these publications as well as on other matters;

INDONESIA - Sofyan Lubis

"The proceedings of the workshop on The Role of Social Organizers in Assisting FMIS is very valuable material for the Centre for Irrigation Development and Studies we organize, particularly concerning social organizers in irrigation development. To enrich the insight of our staff and the library, we need more copies of this book. I would appreciate it very much if more copies are sent to the Centre for Irrigation Development and Studies."

NEPAL - Narayan Pd. Upadhyay

"As a Division Chief of the Technical Services Division of ADB/N, I have the responsibilities of implementation and monitoring of the nationwide FMIS program of ADBN. I am therefore, very keenly interested to receive your Newsletter regularly and would like to take an active part in the FMIS Network. I am prepared to contribute experience based articles or information to the Newsletter and participate in international Seminars and workshops on FMIS."

INDIA - M.D. Pendse

"Incidently I may mention that we received the Aug/90 issue of the FMIS-Newsletter of the Farmer Managed Irrigation System Network published by IIMI. I found it very informative and useful. Therefore I would request you to send all the back issues of this newsletter for our reference."

BANGLADESH - Santhosh Chandra Sarker

"I am an Irrigation professional working with the minor irrigation projects managed by the landless marginal farmers under Proshika Credit Programme. I have the desire to be enrolled as a FMIS Network member of your Institute. I want to get all of your newsletters, magazines, publications etc. which would help us a lot to develop our programme."

INDIA - P. Sampath

"The Water And Land Management Institute, Bhopal, M.P. India is dealing with Water and Land Management aspects of Irrigated Agriculture. In this regard the FMIS Newsletter would be of great use to our faculty members to update their knowledge. Hence you are requested to include WALMI, Bhopal, M.P. India in your mailing list. Director WALMI will very much appreciate if you can send the FMIS Newsletter regularly to our Institute."

PAKISTAN - Frank Van Steenbergen

"I was again impressed by the relevancy and high quality of the IIMI publications."

ZAMBIA - J.B. Siakantu

"Zambia had a number of small-scale irrigation schemes during the late 1960s and 1970s but unfortunately many failed. Now the government has directed us, the researchers, to examine the reasons why some failed, some are operating below par and others are successful. This is the mandate and definitely as the Team-leader of irrigation research in Zambia, I would like close collaboration with you."

UK - M.A. Burton

(On the proceeding on Design...), "It has some very useful papers, particularly the two related to proportional distribution structure. It would be interesting to see how widely these are used. I know of their existence in Nepal and Bali, and have also seen them in traditional irrigation schemes on the slopes of Mount Kilimanjaro in Tanzania. I believe they also exist in South America. A comparative study of their design principles (technical and social) may be informative!"

LAOS - Randali Ireson

"For me, one way the network could be helpful is by providing basic information about the kinds of activity each network member is involved in, for example, training WUGs, developing national or regional policy, construction, etc. Then other members could know what possible resource people would be needed for particular issues. Similarly, it would be very helpful to know of workshops, seminars and/or training sessions being organized by other network members, particularly if there is the possibility of sending observers or participants from other countries or projects. Here in Laos, one of the most important needs is just making the idea of farmer-managed irrigation "visible" to irrigation officials!"

THAILAND - Sinth Sarobol

(On the proceeding on Design and Social Organizers.....) "I appreciate these publications very much as they significantly enhance both the research and development roles of the Payap Research and Development Institute."

THE NETHERLANDS - Silvester Povel

"Thank you very much for sending me a copy of "Improving Management of Small-Scale Irrigation Systems" by Ms. Inge Jungeling. The publication is very interesting indeed, and I wonder whether it would be possible to receive another five copies for our library in Velp, so I could use this publication for teaching purposes."

INDIA - Gokhul Prasad

(on the proceeding on the Role of Social Organizer...) "We have found this publication very useful and we request you to send a copy of this publication to the Water and Land Management Institutes in India, whose addresses are enclosed, if it was not sent to them earlier. All these institutes are engaged in developing farmers organization. The information given in this publication will be quite useful to them."

FAO - CHILE - Matias Prieto-Celi

"I am sure the publications are going to be useful to me in my work. I have also received the information sent by your network."

World Bank - Michael M. Cernea

"The volume on "The Role of Social Organizers in Assisting Farmer-Managed Irrigation Systems" is of great interest to me. It would be very useful also to other colleagues in the Bank who are working on irrigation projects (so, please send more copies, if possible). I want to congratulate you and your associate editors for organizing the workshops which led to this volume. Indeed, the book's topic is crucial and well captured: without social organizers much of what we rhetorically advocate about participation and building farmer organizations as part of the management system in irrigation will simply not happen. Both the conceptual treatment (papers by Pradhan and Sharples and the paper by Karim) and the large set of case studies on irrigation systems and institutional organizers in various countries - Nepal, Indonesia, India, Thailand, Laos, Pakistan and so on - are rich in ideas and in actual experience. I will be using your volume in a large review of experiences with water user associations in Bank financed irrigation projects, which I am scheduled to complete this spring. When ready, I will send you a copy. In the meantime, please convey my congratulations to your associates who contributed to this volume."

PERU - Maria Teress Ore

"In April 1990, a working group on irrigation and water management was started in Lima, Peru. The group consists of about 30 different professionals (engineers, social scientists, etc.) and of different institutions (Universities, Ministry of Agriculture, Non Governmental Organizations, etc.). We would like to receive suggestions about how to establish more intensive relationship of our group with the IIMI."

NEPAL - N. Ansari

"In my organization I am directly responsible for carrying out action research as well as monitoring and evaluation of irrigation systems. One of the branches of my division, the "Research & Training Branch," is engaged in action research and has a modest start in evaluation of few FMISs for the purpose of agency intervention for improvement. However, we would like to receive you cooperation and guidance in this regard to accelerate the activities."

TANZANIA - Mwanitu Kagubila

"One issue that has come up is the performance of these traditional FMIS, in regard to leadership and selection of leaders, land fragmentation and expected yields per hectare, accessibility (distances between homes and rice fields) and absence of farmer resources for better organizational performance (e.g. lack of farmer meeting places within the fields) and many other issues. In this regard, I would be happy to become a coordinator here of a small sub-network on performance of FMISs in Tanzania. Please indicate if it is acceptable so that I may involve other colleagues in this important work immediately." " Right now, we don't have any training materials for FMIS. We do plan to build from several experiences, a kit for the training of leaders of canal committees. Please inform us of any such material if available at IIMI or elsewhere so that we may benefit from them in the future. As you may gather, we are newcomers to this field. Kindly forward to us more materials and advice re FMISs from other countries in Asia."

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