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Rehabilitation of Irrigation Systems in Sri Lanka: A Literature Review

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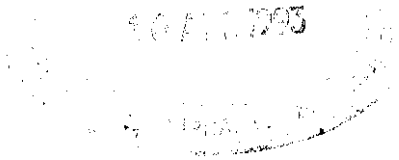

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Coverphotograph, by Jeff Brewer, shows farmers reconstructing **a** field channel, Uda Walawe Rehabilitation Project.

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Foreword

SRI LANKA HAS now had more than twelve years of experience in implementing large-scale donor-funded projects intended to rehabilitate its irrigation schemes and thereby improve their performance. Many of these projects have included research components. As a result, there is a substantial body of literature on the experiences with these rehabilitation projects. Even more important perhaps, several of these rehabilitation projects have enabled a core group of people, both Sri Lankans and others, to gain valuable experience that has enabled them to contribute a lot to the evolution of policies and strategies for improving the rehabilitation strategies adopted by the government, and its policies towards institutional strengthening and system management.

Dr. W. A. Terrence Abeysekera, the author of this study, is uniquely qualified to review the literature on these projects to identify the key lessons learned, and issues requiring further work. He was closely involved in carrying out baseline research for the first of the major rehabilitation projects, the Tank Improvement and Modernization Project (TIMP); he completed his Ph.D. thesis based on his research on this project. The research organization responsible for this work, the Agrarian Research and Training Institute (ARTI), played a key role in the second such project, the Gal Oya Water Management Project, which has been the source of many important irrigation management lessons — and has generated more research than any other such project in Sri Lanka.

The Irrigation Systems Management Project (ISMP) was designed to build on the lessons learned in the previous projects, particularly the Gal Oya Project, and refine them further. Through this project, the Irrigation Department and Irrigation Management Division are testing more cost-effective rehabilitation strategies, and also putting a great emphasis on building farmers' organizations and a partnership between these organizations and the

government irrigation agencies. As part of the **ISM** Project, the International lmgation Management Institute (IIMI) is implementing a set of action-research activities under a cooperative agreement with the United States Agency for International Development (USAID).

This publication is one of the key outputs of these research activities. It **is** designed to evaluate the existing documentation and literature on four major donor-funded projects, two of which were completed by the mid-1980s (TIMP and Gal Oya), and twoofwhich will be completed in mid-1992 (ISMP and the Major Irrigation Rehabilitation Project [MIRP]). **Gal** Oya and ISMP have received funding support from USAID; TIMP and MIRP have been supported by the World Bank with supplementary funds from other donors.

The purpose of this report is to identify the lessons that have emerged from the implementation of these projects based on available literature, and the gaps that need to be filled by additional research. It brings out clearly a number of lessons learned, some of which have been incorporated in recent projects, and some not. Many of these lessons are applicable not only to Sri Lanka but more widely. The lessons include: the importance of involving farmers from the beginning and using the improvement **process** to build farmers' organizations; the effectiveness of specially trained catalysts for organizing farmers; the importance of addressing agricultural. technological. marketing, and other issues as well **as** irrigation problems; and the necessity to build in better monitoring and evaluation processes.

In addition to these conclusions, the report also identifies a number of important issues requiring further research. For example, none of the projects completed six to seven years ago have been evaluated since. Therefore, under its ISM Project Cooperative Agreement, IIMI has initiated a study that will evaluate the performance, impact, sustainability, and economic benefits of the two large completed projects, and in the light of these findings, evaluate the likely outcomes of the two projects being implemented. The two studies, i.e., the present one by Dr. Abeysekera and the evaluation study just beginning, will provide a firm basis for recommending clear guidelines to the government for future planning and implementation of cost-effective modernization projects.

All of the work done under the ISM Project Cooperative Agreement is guided by a very active Research Advisory Committee. This Committee is chaired by the Director **of** the Irrigation Management Division (IMD), and includes the ISM Project Director and other representative!; of the IMD, the

Irrigation Department, the consultants to the Project (Sheladia Associates Inc.), and USAID. The Committee is a very active and critical one, which takes a strong interest in ensuring that the research is useful and relevant.

On behalf of IIMI, I would like to express our appreciation of the active role of the Research Advisory Committee, and particularly the ISM Project Director, Mr. G. T. Jaywardena; the Director of IMD, Mr. D. M. Ariyaratne; and the USAID Project Officer. Mr. Dan Jenkins. IIMI is also most grateful to USAID for its generous funding and active support of the research component of the ISM Project, through its Cooperative Agreement with IIMI.

Finally, I would like to thank Dr. Terrence Abeysekera, currently with the Sri Lanka Office of the World Bank, for having done such a large amount of work, and having responded magnificently when IIMI and the Committee members raised more and more questions, and asked for more and more details. We believe the result is an excellent piece of work, of great value to policymaken, irrigation management practitioners. and researchers not only in Sri Lanka hut in other countries as well.

Douglas J. Merrey
Former Head, Sri Lanka Field Operations
International Irrigation Management Institute

August, 1992

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THE AUTHOR IS particularly thankful to Dr. Douglas *J. Merrey* and *Dr.* **R.** Sakthivadivel of IIMI's Sri Lanka Field Operations for helpful comments on earlier versions of this paper and for the support and encouragement given **to** complete this work. The author would also like to thank various reviewers for their comments, including in particular Mr. Dan Jenkins of the United States Agency for International Development, Mr. U.N.S. Wickramaratchi of the Irrigation Management Division and Dr. Jeffrey D. Brewer of IIMI. The opinions expressed are solely those of the author.

Executive Summary

THIS STUDY, INITIATED by the Sri Lanka Field Operations (SLFO) of the International Irrigation Management Institute (IIMI), provides a review of five selected major irrigation rehabilitation projects in Sri Lanka, mainly to draw lessons and to identify key research issues.

Sri Lanka's irrigation sector entered a new era of major rehabilitation activities in the late 1970s. Since then, the basic concepts, objectives and improvement strategies of rehabilitation projects have undergone a significant evolution. The change mainly reflects a move towards adopting a participatory mode of management with a greater emphasis on "software" aspects. Past experiences clearly show that the conventional approach of official-dominated central planning with a heavy construction bias in irrigation system rehabilitation has failed in achieving the expected goals.

The study highlights the inadequacy of research on socioeconomic as well as technical aspects as a major deficiency hindering the development of the irrigation sector. Despite a rapid growth in the country's irrigation investments in the 1980s, the volume of research on rehabilitation has not increased during this period. After an initial surge in the early 1980s, the volume of research has, in fact, declined in the more recent years. Evidence strongly suggests that unless new production techniques are introduced, it would not be possible to maintain the economic viability of the current as well as future investments on rehabilitation.

The more significant lessons emerging from the past experiences are:

1. Increasing need for pursuing cost-effective rehabilitation strategies, and the usefulness of management-oriented strategies as a means of achieving greater project viability.

2. Usefulness of farmers' organizations as a major vehicle for mobilizing farmer participation and local resources.

3. Need for establishing a reliable information base prior to project design.

4. Critical role played by nonwater factors in determining the overall success of rehabilitated systems.

5. Recognition of the importance of introducing new agricultural and water control technologies to improve irrigation system performance.

The more significant research issues emerging from the literature survey are:

1. Evaluation and establishment of criteria for assessing the rehabilitation needs in the irrigation sector.

2. Impact assessment of completed as well as ongoing rehabilitation projects with emphasis on irrigation, agricultural, employment and income consequences.

3. Comparative studies on cost-effectiveness of alternative rehabilitation and O&M options.

4. Investigations of issues relating to sustainability of rehabilitation projects.

5. Studies designed to improve and strengthen the institutional capacitie of the irrigation schemes, at local as well as provincial levels.

6. Technical research programs on irrigation and agronomic aspects leading to the generation, testing anddissemination of new technogies.

7. Studies on irrigation cost recovery, use and disbursement of funds.

8. Studies on problems affecting irrigation system performance.

9. Transfer and communication of lessons.

PART 1

CHAPTER 1

Introduction

EMERGING EMPHASIS ON REHABILITATION

EXPANSION OF THE land area under cultivation through the development of irrigation systems and land settlement has been a principal investment strategy of all governments in Sri Lanka for achieving the national goal of food self-sufficiency. The process of expanding the land area has been dominated by investments in the construction of new imgation systems. During the last four decades the investments in new construction have experienced threepeaks, in the early 1950s, the late 1960s and the late 1970s.

The total irrigated area in Sri Lanka has expanded considerably in the past few decades and reached 520,000hectares (ha) in 1990. Most of the increase in the irrigated area since the late 1970s is due to the implementation of the Accelerated Mahaweli Development Programme, the government's largest public sector investment during this period. The program, in its peak year of 1984, accounted for ahout 39 percent of the public sector capital investment and 90 percent of all investments in the imgation sector. Of the total irrigated area in Sri Lanka in 1990, ahout 350,000 ha were served by ahout 400 major or medium-sized schemes (including about 45,000 ha under Mahaweli) and about 170,000 ha of irrigated lands were served by about 22,000 minor (village) irrigation schemes.

More or less coinciding with the coinpletion of Mahaweli works, Sri Lanka's irrigation sector now appears to have entered a new development phase, distinguished by the heavy emphasis on the rehabilitation and management of the existing irrigation resources, rather than on constructing new systems (Table 1).

Most ofthepresent irrigation systemsin Sri Lanka are 30–50 years old and some of them, for a variety of reasons, are currently showing the need for

rehabilitation and improvement. In recognition of this need, governments since the late 1970s have implemented a number of rehabilitation projects.

Table 1. *Growth pattern of irrigation investments in Sri Lanka, 1950–88.*

Year	Inigation investment' (Rs million)							Share of the total irrigation investmeni in	
	New Construction[b]		Rehabili-tation[c]		Operation and maintenance		Total	Total government budget	Total public investmen
	(Rs M)	(%)	(Rs M)	(%)	(Rs M)	(%)	(Rs M)	(%)	(%)
1950	907	96	-	-	34	4	941	8	37
1955	a59	96	-	-	38	4	897	6	29
1960	601	83	-	-	121	17	722	3	19
1965	619	91	-	-	62	9	681	3	15
1970	994	93	-	-	78	7	1072	3	16
1975	1116	89	-	-	127	10	1248	2	13
1980	3023	89	225	7	137	4	3385	6	21
1985	2770	82	451	13	154	5	3375	6	18
1988	1676	80	308	15	102	5	2086	3	

'Expressed in 1986 currency as five-yearaverages centering on the years shown.
[b]Investments for constructing new systems or restoring old systems. Only irrigation-infrastructure-relatedinvestments, such as those for tanks and canals, are included.
"Investmentsfor rehabilitation and for modernizing existing systems.
[d]Not including overhead costs such as personnel emoluments or administrative expenditures.

Note: na = *not* available.
Source: Aluvihare and Kikuchi (1990, Table 6).

OBJECTIVES AND SCOPE OF THE REVIEW

The main purpose of this literature survey is to provide insights into the planning, plan implementation, operation and post-project performance of

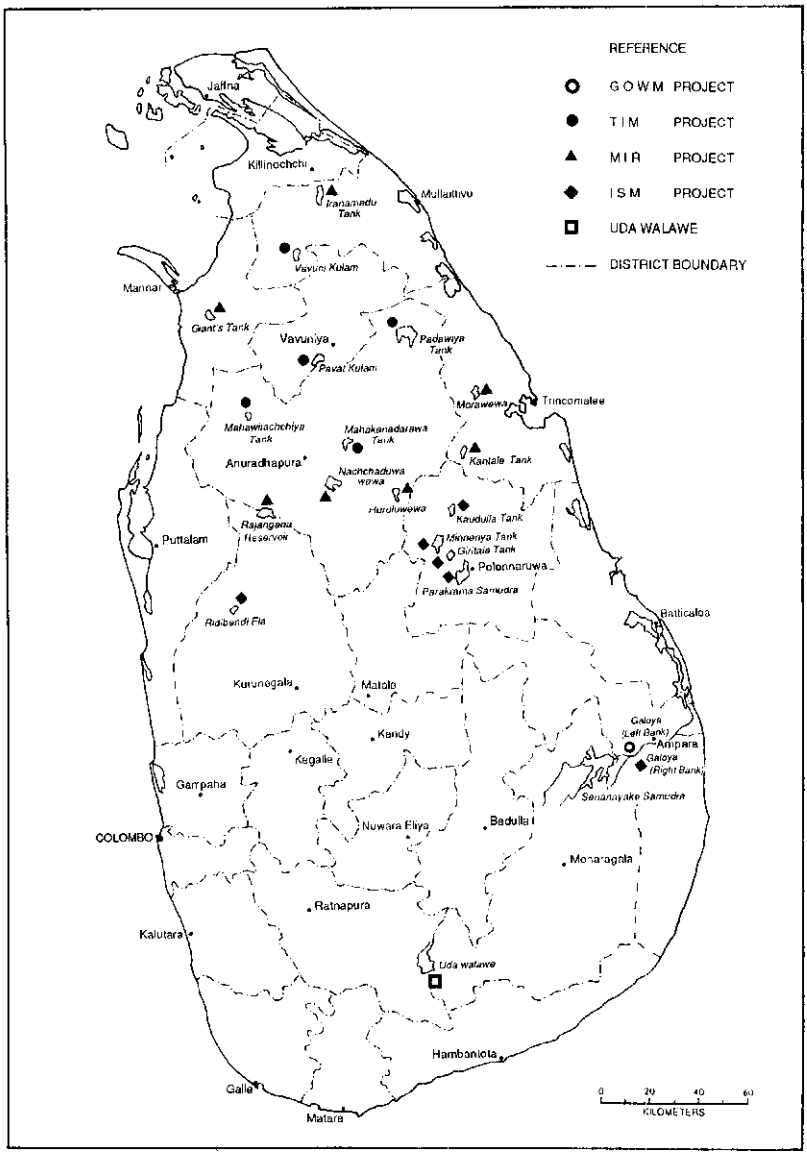
major irrigation rehabilitation projects in Sri Lanka, primarily to draw lessons and identify problems emerging from past experiences, and to identify key research areas that require further attention.

The review focuses on five selected major irrigation rehabilitation projects: Tank Irrigation Modernization Project (TIMP), Major Irrigation Rehabilitation Project (MIRP), Gal Oya Water Management Project (GOWMP), Irrigation System Management Project (ISMP) and Uda Walawe Modernization Project (UWMP). These projects account for the hulk of the major irrigation rehabilitation activities in the country. Figure 1 shows the locations of these projects.

In addition to these large rehabilitation projects, the government bas also undertaken a large number of other irrigation rehabilitation projects such as the Village Irrigation Rehabilitation Project (VIRP), Anuradhapura Dry-Zone Agriculture Project (ADZAP) and Minipe-Nagadeepa Rehabilitation Programme. Moreover, a large number of minor imgation schemes throughout the country have also been rehabilitated through the Integrated Rural Development Projects (IRDPs). A National Irrigation Rehabilitation Project (NIRP), funded primarily by tbe World Bank, is just getting underway as a follow-up to VIRP.

Except for a brief review undertaken by Merrey (1987), no attempt has so far been made to prepare a comprehensive review covering the major irrigation rehahilitation works in Sri Lanka. The review undertaken by Merrey focuses attention on the institution building process in the rehabilitated irrigation schemes and examines the hypothesis that projects which are built on strong farmers' organizations are more likely to exhibit sustainable improvements in productivity and ensure equity than those schemes which primarily emphasize physical construction.

6 *Figure 1. Locations of selected major irrigation rehabilitation projects.*



ANALYTICAL FRAMEWORK

The presentation of information and analysis in this review corresponds to an analytical structure composed of the following broad elements:

1. Project identification, formulation and planning

   This component mainly focuses on the development goals and strategies, project formulation process, planning, and designing of the rehabilitation project. The assumptions underlying the development approach of the project, their bases and validity are also examined. Most of this information comes from appraisal reports and bench-mark surveys.

2. Project implementation, organization and operation

   The review focuses on the nature and level of beneficiary participation, implementation procedures followed, institutional mechanisms, procedures adopted for construction and O&M activities, feedback and monitoring activities and degree of mobilization of local resources for rehabilitation work and their sustainability.

3. Rehabilitation costs

   Specific information on the actual costs of rehabilitation is difficult to establish. Subject to this limitation, the review provides some information on total costs and cost-related issues.

4. Project impact and sustainability of outcome

   Information in this regard is reviewed primarily with respect to innovations and achievements in the areas of agriculture, irrigation and institutional development. Snstainability and replicability of the project outcomes in other projects are also given attention.

ORGANIZATION OF THE PAPER

The presentation is organized under three main parts. Part 1 gives an introduction to the study and data sources. **Part II**, comprising chapters 2–6, provides information relating to each of the five rehabilitation projects on a case-by-case basis. **Part III** discusses the more important lessons learned (Chapter 7) and the priority research areas (Chapter 8). The bibliography provided at the end contains entries categorized by project.

PART 2

CHAPTER 2

Tank Irrigation Modernization Project

THE TANK IRRIGATION Modernization Project (TIMP) is the first large-scale irrigation rehabilitationexercise undertaken in Sri Lanka. The project covers a total area of about **12,753** hectares (ha) **of** irrigable land in five major irrigation schemes located in the North Central **Dry** Zone, which had previously been restored in the early **1950s.** The schemes covered are: Mahawilachchiya **(1,053** ha), Mahakanadarawa **(2,429** ha), Pavatkulam **(1,619** ha), Vavunikulam **(2,429** ha) and Padaviya **(5,061** ha). The project was identifiedin **1973,**preparedduring **1974** andimplementedduring **1976–82.**

Climatically, the project is located in a relatively *dry* area with a high rainfall variability. The area is affected by severe droughts, at least once in 4–6 years, causing major setbacks to its agricultural production. All **tank** schemes in TIMP are associated with small and poor catchments and, as a result, the agricultural production pattern in the project area shows a remarkable variability induced by rainfall fluctuations.

PROJECT IDENTIFICATION AND SELECTION

The specific criteria used in identifying the five irrigation schemes to be included in TIMP are not indicated in the project documents. However, it appears that the choice of these schemes has been influenced largely by issues such as poverty and regional equity with better income distribution.

MAJOR PROJECT OBJECTIVES

The basic goal of TIMP, as outlined in the appraisal report, was to increase the agricultural production in the irrigable lands in the project area through increased land-use intensity and the adoption of a package of irrigation and agricultural innovations (World Bank **1976).** The TIMP plans projected major increases in the annual cropping intensity of the imgated land in the area, from 83 percent to 170 percent, within a period of **5** years. The project was aimed at conserving irrigation water stored in the reservoir and maximizing the use of *maha* (main wet season) rainfall, thereby increasing the agricultural potential.

Along with this increase in cultivated land, large increases in crop yields were also anticipated. Rice yields during the maha season were expected to double, from **1.7** tons per ha to 3.4 tons per ha.

The total mahaseason rice production was expected to increase from **1,567** metric tons to about **4,180** metric tons, reflecting an increase of about 270 percent.

The expected increases in agricultural production in yala (secondary wet season) were even moredramatic. For instance, in Mahawilachchiya Scheme, the cultivated area during the yala season was projected to increase four-and-a-half times, from 81 ha to **365** ha. The area under nonrice crops, mainly pulses, was projected to increase sevenfold in a five-year period. The plan expected a major increase in nonrice crop production, from 19.8 tons to 700 tons. Total rice output during the yala season was estimated to increase from **154** tons to 1,386 tons, a ninefold increase.

The goals of TIMP were, therefore, based on radical transformationsofthe agricultural pattern in the area through which significant increases in farm incomes were anticipated. Net farm income was expected to rise from the existing level of Rs 2,850 to a post-project level of Rs **7,650.**

MAJOR PROBLEMS AND IMPROVEMENT STRATEGIES ADOPTED

The main problems identified in the project were:

1. Inefficient use of maha rainfall and wasteful use of irrigation water by farmers.

2 Poor agricultural extension facilities.

3. Unsatisfactory farm roads, causing problems in marketing.

The project appraisal report recognized that under the existing cultivation practices, fanners rely heavily on chena (slash-and-bum) cultivation. Typically, farmers engage in preparing their chena lands before the onset of the rains and planting activities in the chena are undertaken with the arrival of the rains. Farmers turn their attention to rice fields only after the completion of chena work. Almost as a rule, farmers in the project area wait until the tank becomes full, before they begin any land preparation work in the rice fields (World Bank 1985). Because of this delay in preparing rice lands, by the time the sowing activities are completed most of the heavy rains are generally over. The appraisal report also identified that farmers use too much water for preparing land for rice cultivation.

Thus, the overall development plan of TIMP was based on a strategy to conserve and maximize the maha season rainfall. An assumption implicit in this plan is that, once the irrigation system is modernized and improved to provide better water distribution and management, farmers would automatically follow the project recommendations, would give up chena cultivation and intensify the cultivation of their irrigated holdings. This assumption, as proved later, seriously underestimated the role of chena cultivation and other traditional cultivation methods that have been practiced in the area for centuries.

The basic strategy underlying the **TIMP** development plan involved two major components:

1. The development of agricultural production in the area.

2. The improvement of the irrigation water use and management.

The agricultural component recommended a package of practices to be followed by the farmers. This included

1. Preparation of rice lands under dry soil conditions (*dry* tillage) wihout waiting for the maha rains.

2. Advancing the sowing time of rice to benefit from initial maha season rains that would otherwise be unutilized.

3. Dry sawing of ungerminated seed paddy as a substitute for the conventional system of sowing germinated seed paddy under wet conditions (to reduce high levels of water use in land preparation under wet conditions).

4. Cultivation of short-duration (3 to 3 1/2 month) rice varieties during the maha season to reduce the irrigation period.

These recommendations, therefore, constituted a package requiring a high level of tractor use, timely availability of water supplies, hetter water control and the availability of short-duration rice varieties.

The irrigation improvement strategy of TIMP, on the other hand, involved the adoption of several innovations that basically require major structural changes in the water conveyance system **to** allow better water control and delivery. Such changes were aimed at introducing a rotational (intermittent) system of irrigation water distribution at the farm (tertiary-canal) level. In order to introduce the system of rotations, the channel system was redesigned and new contmls and measurement devices were installed along the channels.

The major irrigation-related innovations in TIMP were:

1. Introduction of rectangular channels of one cusec (28.3 liters per second) capacity.

2. Construction of a lined channel system to reduce seepage losses.

3. Installation of larger (15 cm) farm pipe outlets

4. Construction of control and measuring structures

5. Implementation of a strict 12-hour rotational system of water issues.

These changes necessitated a great deal of construction work, and provided a heavy engineering orientation to TIMP.

SOURCE OF TIMP IMPROVEMENT STRATEGIES

The basis of the agricultural technologies adopted in TIMP is mostly derived from the early findings of a major field experimentation program conducted in the Walagambahuwa minor tank scheme in Anuradhapura District in the mid-1970s. These experiments indicated that agronomic practices such as early planting of rice, dry sowing of ungerminated seed, cultivation of short-season rice varieties, and the use of tractors for land preparation are potentially useful means for reducing the demand for irrigation water in water-deficit areas in the dry zone (Upasena 1980). As the ecological conditions in the TIMP area are close to those of the Walagambahuwa tank area, the TIMP planners have adopted the Walagambahuwa model of agricultural development to the TIMP as well.

It is significant to note that the encouraging results emerging from Walagambahuwa in its early years were rather deceptive and were not sustained later. In the early years, the apparent success of the Walagambahuwa model was nurtured by good rainfall conditions. In low-rainfall years, farmers in Walagambahuwa abandoned the new innovations and returned to their traditional cropping system dominated by chena cultivation.

The inappropriateness of these agricultural strategies to the TIMP area and their likelihood to fail under poor rainfall conditions have been confirmed by a detailed tank water balance study by Abeysekera (1986). The study highlighted that agricultural strategies in TIMP could deliver expectations only under circumstances of average and above-average rainfall.

PROJECT PLANNING PROCESS

The TIMP plans were largely based on the socioeconomic information provided by a rapid appraisal of the project area, conducted by the Agricultural Economics Division of the Department of Agriculture just before the project appraisal.

The planning process, in general, reflects a relatively rigid, top-down approach with little participation of the actual beneficiaries. The proposed improvements appear to have been conceived and designed centrally, with little involvement of the officials and farmers. In fact, farmers' organizations were not present in the project area at the time of initiating the project and this appeared to he a major cause for the lack of farmer participalion, in spite of which, the project did not even attempt to organize farmers to obtain their views.

PROJECT COSTS AND COMPONENTS

The project was funded by the World Bank. The total estimated cost was about US$30.0 million (Rs 225 million), including about US$7.0 million in import taxes and duties (1976 prices). The project activities broadly included: construction work for improving irrigation, drainage facilities, and farm roads; provision of equipment for land preparation and plant protection; strengthening of agricultural support services; and provision of technical support for strengthening O&M work.

The cost data (Table 2) show that civil works, and equipment and machinery imports accounted for nearly 85 percent of TIMP's total project expenditure. The irrigation improvement component, in particular, was highly capital-intensive and accounted for 29 percent of the total cost. The cost profile indicates a large foreign exchange component allocated for importing machinery and vehicles. As part of the project, a large number of tractors were imported to be sold to the settlers.

Table 2. *Major cost* components *of TIMP (in 1976 currency).*

Item	Cost	
	(US$ M)	(%)
Civil works	8.7	29.0
Construction equipment and vehicles	5 6	18.7
Agricultural equipment and vehicles	5.6	18.7
Technical assistance	0.3	1.0
Engineering and administration	1.3	4.2
Contingencies	1.7	5.7
Price contingencies	6.8	22.7
Total	30.0	100.0

Source: Project Appraisal Report. World **Bank,** 1976.

ORGANIZATION OF THE PROJECT

In order to implement the rehabilitation program, a three-tiered organizational structure was outlined in the project proposal (World Bank **1985).** At thehighest level, there was a Central Coordination Committee in the Ministry of Lands and Land Development, chaired by the Secretary of the Ministry. This committee included representatives from other departments responsible for project implementation such as the Department of Agriculture. Quarterly meetings of this committee were held to review the progress of the work. At the middle level, the project activities were handled by the District Coordination Committee, chaired by the Chief Project Engineer (CPE). The CPE wasresponsible forthecoordinationofroutineactivities. At the lowest level, the project work was expected to be supervised by the Tank Committee, chaired by the Project Engineer. It was expected that this committee would include both government officials engaged in agricultural activities in the scheme and elected members of farmers.

Although these institutional arrangements were expected to function actively from the very inception of the project, in fact, they did not function effectively. Of the three levels of the organization, the least effective was that **at** the tank level (the Tank Committee). In fact, throughout the period of project implementation, the Tank Committees were nonfunctional (Abeysekera **1986).** Although there were monthly meetings at ministry level, most of the

discussions were centered on evaluating the project progress only in terms of its physical achievements such as cubes of soil excavated, length of channels lined, number of structures completed, etc.

The project organization suffered major problems of coordination among different government agencies involved in TIMP. This was mainly due to a lack of coordination of all activities at a higher level (World Bank 1979). As a result, a project manager was appointed in 1980 to coordinate and implement the project. However, the new organizational arrangement too faced administrative difficulties and was discontinued. With this, the project administration was handed back to the Irrigation Department. A noteworthy problem in the organizational structures of TIMP is that it did not allow effective interaction between the key agencies carrying out various functions in the project such as the Irrigation Department and the Department of Agriculture.

The project organization activities, in overall terms, failed to incorporate any needed change. The project implementors faithfully adhered to the blueprint prepared by the engineers at the beginning of the project.

However, towards the latter part of project implementation, some flexibility seems to have been introduced, as illustrated by the water distribution system. For example, the original project design envisaged limited irrigation deliveries of 12 hours per day so that fanners would have to irrigate at night. However, when the detailed rotational schedules were prepared to achieve this objective, it proved impossible to operate night time rotations and some adjustments were made.

BENEFICIARY PARTICIPATION

Although the establishment of Tank Committees in TIMP, involving farmers at the tank level, was a significant idea, the project had no specific plans to organize farmers. The existing *Vel Vidanes* (farmer representatives) were deployed by the project to undertake water management and other related tasks, including implementation of the rotational schedules, representation of the farmers at the Tank Committee, and coordination with government officers. The arrangement did not operate satisfactorily, mainly because the project managers did not realize that Vel Vidanes were unacceptable to

fanners as their representatives. Having realized this, efforts were made to organize field channel groups with contact fanners in a system similar to that of the Training and Visit (T&V) system in the Department of Agriculture. This effort was introduced after most construction work was completed and was, thus, ineffective.

PROJECT ACHIEVEMENTS

Despite a large capital expenditure, the actual performance of TIMP in the initial years was disappointing (Abeysekera 1983). The rotational system of irrigation water distribution, upon which most of the expectations of agricultural change were based, led to many major operational problems. The modernized conveyance systems suffered considerable damage, often at the hands of farmers responding to the nonfunctioning of the new construction work.

Post-evaluation studies indicate that, for many reasons, farmers did not accept the improvement package and were reluctant to change their traditional cultivation practices (Abeysekera 1986, Murray-Rust and Rao 1987a and 1987b). In fact, practices such as dry sowing and early sowing were completely rejected by fanners and they continued to engage themselves in chena cultivation. As regards rice, they continued to show their traditional preference to ensure one good maha season rice crop using long-duration (4–4 ½ months) varieties, planted rather late in the season when the tank was full.

Despite the formation of many committees, the project administration also showed major weaknesses. As a result, virtually all activities and responsibilities of undertaking the project work were in the hands of the project engineers in the respective schemes. This led to a perception of the project as an engineering activity with a strong construction orientation. This perception led to the neglect of other complementary aspects of the problem (such as the multidisciplinary aspect) and beneficiary participation.

Being the first major irrigation rehabilitation project in Sri Lanka, TIMP has been widely studied and discussed. Prior to the commencement of the project, comprehensive benchmark studies covering a wide range of aspects were undertaken by the Agrarian Research and Training Institute (ARTI).

The investigations basically covered social, economic, agricultural and technical aspects of the five irrigation systems, prior to modernization (ARTI 1979a, 1979b).

Based on the benchmark studies, Ranatunga, Farrington and Abeysekera (1981) attempted to reflect on some of the issues raised in the project appraisal report. The report discussed the problems and proposed solutions as well as the weaknesses of the appraisal, and identified potential problems likely to hinder the progress of the envisaged crop diversification. The report indicated that crop diversification would require a long period of work and a multidisciplinary effort. It also indicated a potential to increase cropping intensities and yields of the tail-end farmers.

SUSTAINABILITY OF PROJECT ACHIEVEMENTS

Although TIMP has been operational for over a decade, so far no research investigations have been conducted to examine the long-term impact of the project. However, detailed studies assessing the post-impact evaluation almost immediately after the project completion, conducted by Abeysekera in 1985 (Abeysekera 1986a and 1986b) and Kariyawasam in 1983 (Kariyawasam et al. 1984), provide insights into the likely long-term sustainahility of the project. In general, both these studies raise doubts about the long-tern viability of the project development strategies. The findings suggest that the basic agricultural and irrigation problems would remain after the project investment is over.

The study by Aheysekera was based on a large body of data gathered from farmers, officials and official records. The investigation focused on the Mahawilachchiya Tank. The analysis showed that TIMP was introduced in a complex situation involving a number of fundamental problems like the growing population pressure, rainfall uncertainty and withdrawal of government support. It also showed that the rejection of the solutions offered (such as dry tillage, *dry* sowing, irrigation rotation at the field-channel level and growing nonrice crops in the dry season) to solve the basic problems in the area was mainly due lo uncertainty of rainfall and lack of profitability. With the rejection of recommended practices, by the farmers, the physical improvements implemented under TIMP also became redundant.

The study also showed that although tractors were made available, the farmers did not change their traditional method of land preparation because of uncertain water availability. Dry tillage and dry sowing were never practiced by farmers. They preferred to ensure one good maha season rice crop by planting long-term (4–4½ months) varieties, using irrigation water for land preparation.

The analysis suggests the need for a comprehensive strategy that would involve the cooperation of farmers as well as officials engaged in agriculture and irrigation with intensive field efforts and training of officials and assistance of political authorities. Such issues do not seem to have been considered adequately in the project design.

A study hy Kariyawasam (1984) with respect to the availability of water and tank hydrology in the Mahakanadarawa scheme, concluded that one of the major contributory factors for the failure of this tank was the rehabilitation of small tanks in its catchment area. These rehabilitation activities were undertaken by nongovernmental organizations. The study emphasized the need for closer coordination between the agencies undertaking rehabilitation work and the Irrigation Department.

An analysis of TIMP was also undertaken by Murray Rust and Rao (1987a and 1987b), based mostly on secondary data. This study also confirms that the uncertainty of water and a lack of marketing arrangements were major constraints to both cropdiversification and the adoption of nonrice crops. The study showed that water management has been a problematic issue not only because of the heterogeneity of the soils under a turnout hut also due to a lack of farmer cooperation to implement the agreed rotational schedules.

Although the specific lessons emerging from TIMP do not provide very positive results, the experiences have contributed significantly to a deeper understanding of the implementation and operation of rehabilitation projects in Sri Lanka. The project clearly demonstrated that a construction activity alone, devoid of a management orientation, would not be a success. Similarly, TIMP also demonstrated that the technical feasibility of a development strategy alone is insufficient to guarantee success. This lesson, therefore, highlights the need for economic feasibility of the operational plans, viewed from the farmers' perspective.

A unique feature associated with the TIMP development approach is that the project design specifically recognized that the adoption of technological options would play an indispensable role in improving the poor, stagnating

economies in irrigation schemes. The TIMP experience clearly demonstrates that unless farmers are convinced of sustained and substantial economic benefits (either by lowering production costs and/or increasing returns), they would not accept new improvement programs or production technologies. Unfortunately, however, in the case of TIMP, the recommended technologies were inappropriate and the project did not yield the expected results.

CHAPTER 3

Gal Oya Water Management Project

THE WATER MANAGEMENT Project, usually called the Gal Oya Water Management Project, was initiated with the assistance of USAID and involved the rehabilitation of one of the largest irrigation schemes in Sri Lanka. Feasibility studies were completed in 1979 and the project was implemented through December 1985.

PROJECT OBJECTIVES

The project was designed with a number of broad objectives for intensifying irrigated agriculture in the Gal Oya scheme. Among them, perhaps the most significant, is the development of institutional capacity in the Irrigation Department, which would enable it to manage large irrigation schemes more efficiently. The objectives outlined in the project paper (USAID 1979) were:

1. Physical rehabilitation of the Gal Oya Left **Bank** Irrigation System, whose command area is about 23,000 ha. The main canal and distributary channels were to be redesigned and repaired, primarily with a view to bringing the system back to its original design specifications.
2. Preparation of water management plans for the Gal Oya Left Bank, based on on-farm research, with a view to minimizing water losses.
3. Training of Irrigation Department personnel, farmers and others in water management practices.
4. Training of officials engaged in agriculture and other technical fields in the Gal Oya Left Bank, provision of improved central support for the development

of a water management unit of the Irrigation Department to administer the project in Gal Oya, and the development of the Galgamuwa Irrigation Training Institute to provide operation and maintenance support throughout the country.

5. Organizing farmers and conducting socioeconomic research relating to the development of farmers' organizations or local water users' associations in the Gal Oya Left Bank as well as evaluating the impact of the project.

PROJECT DEVELOPMENT STRATEGY

The development strategies adopted in Gal Oya were influenced by TIMP and other experiences, particularly with respect to issues such as beneficiary participation as well as capital costs and operation and maintenance costs. Unlike in TIMP, the Gal Oya Project, from the inception, placed a heavy emphasis on farmer involvement in system rehabilitation and improvement, reflecting a "bottom-up" development approach. The creation of farmers' organizations was facilitated by the Institutional Organizers (IOs) functioning at the field level.

The emphasis on fanner involvement, however, is not seen in the original project design, hut came as a subsequent development, mainly because of the involvement of the Agrarian Research and Training Institute (ARTI) and Cornell University in project implementational activities.

PLANNING PROCESS

The overall planning process underlying the Gal Oya Water Management Project reflects a high degree of flexibility. The actual implementation of the project differed significantly from that envisaged in the original project design. The original project paper, for instance, laid major emphasis on the use of heavy equipment for physical rehabilitation. Although the equipment was provided, because of problems such as low utilization and difficulties of maintenance, arrangements were later made to make use of local labor wherever possible. The original plan also emphasized detailed planning and the preparation of master plans, but these were later de-emphasized. A realistic approach to design and

implementation of civil works was later modified through the adoption of a "pragmatic" approach to design and construction, as suggested by the mid-term evaluation. In the original plan, a specific plan and specific funding for rehabilitation of distributary and field channels were not included, but these were provided in a later amendment to the project paper (USAID 1982).

PROJECT IMPLEMENTATION

The actual implementation of the project placed heavy emphasis on the establishment and development of farmers' organizations as a major vehicle for mobilizing farmer participation. This activity was carried out by ARTI with assistance from the Cornell University. Initially, ARTI was expected to develop and establish a number of preconceived models of water users' groups. However, this approach was not followed; instead, the project utilized a novel approach of using Institutional Organizers (IOs) or catalysts to initiate and develop farmers' organizations. Although the approach of using IOs was new to the area of irrigation management in Sri Lanka, similar approaches had been adopted in other rural development programs in Sri Lanka and irrigation projects in other countries.

Along with the introduction of farmers' organizations, the project also emphasized the significance of socioeconomic research. As a result of the heavy emphasis on the research component, a large number of research studies were undertaken during the project period.

IMPROVEMENT STRATEGIES ADOPTED

The Gal Oya Project was an important event in the history of rehabilitating irrigation systems in Sri Lanka. A significant aspect of this project was the use of farmer participation as a means of achieving low-cost rehabilitation, and operation and maintenance. A key strategy adopted in the Gal Oya Water Management Project is "pragmatic rehabilitation." This strategy is a major departure from the usual "text book" approach of setting standards and criteria. The main objective of pragmatic rehabilitation was to ensure canal safety,

stability and utility with a minimum level of expenditure (Keller et al. 1982). The approach reduced the costs of surveying, designing and construction substantially.

Another key strategy adopted in this project is the mobilization of local knowledge and user participation in system improvement and management, and these strategies proved quite successful (Uphoff 1986a). Farmer participation in the design process through group approaches was encouraged. During the early phase of project design, each farmer group had two rounds of meetings with the engineers. Later, however. this was replaced with "walk-along-the-channel" meetings.

Unlike TIMP, the Gal Oya Water Management Project did not include a specific agricultural development strategy. A basic assumption implicit in the project plans appears to be that when the water management activities are improved, the agricultural activities would also he transformed favorably.

PROJECT COSTS

The total project cost, as estimated in 1978 (Table 3), amounted to US$18.34 million (USAID 1979). Of this, US$3.0 million was from proposed USAID grant funding, US$6.8 million from loan funding and US$8.54 million (rupee equivalent) from the government.

Table 3. Cost composition of the Gal Oya Water Management Project (in 1978 currency).

Item	Cost	
	(US$'000)	(%)
Technical assistance	2,450	13.4
Commodities	6.250	34.1
Training	930	5.1
Personnel	1,540	8.4
Other costs (including construction)	2,980	16.2
Contingencies and inflation	4,190	22.8
Total	18,340	100.0

Source: USAID 1979.

STUDIES ON PROJECT EVALUATION

The Gal Oya Water Management Project is the most researched rehabilitation project in Sri Lanka and consequently a wide range of literature is available on this project. However, in the early years of the project, a useful study was conducted by a review team of five members (Keller et al. 1982). The study, a formal mid-tern evaluation, was intended mainly to serve as a project review and to suggest recommendations for improvement. The review indicated that although the irrigation system showed some efficiency due to reuse of water, a major constraint reducing efficiency was the high levels of water consumption.

The review also emphasized the need for institutional development and the significance of water users' associations, while pointing out that the rehabilitation of the irrigation system and the envisaged O&M measures would not be possible unless farmer interests are mobilized through appropriate mechanisms and institutional improvements. The report suggested that if the Irrigation Department was unwilling to accept the challenges inherent in the new approach, then efforts should be made to find another agency that would accept this responsibility.

A key innovation recommended was the approach of "pragmatic rehabilitation" mentioned above. At the very inception of the pmject, the Irrigation Department and its foreign consultants had adopted a conventional approach for

rehabilitating channel systems which proved to be expensive and slow. The objective of bringing the system back to its original design was not only unrealistic but, in fact, impossible to achieve. In the new approach, the basic idea was to "conduct a physical inspection of the system and to determine what was needed to be done to ensure hydraulic efficiency and to stabilize the canal banks." This approach relied heavily on the judgment and experience of the design engineers. The adoption of this approach has been reported to be successful, mainly because of the availability of experienced engineering skills within the project.

The project consultant's final report provides a detailed account of the activities of the project (PRC 1985b). This includes the project outputs, the problems encountered and the lessons relevant to future rehabilitation projects. The findings cover a wide range of issues and major points highlighted in this report are:

1. Although the inputs from water users' associations (WUAs) are extremely useful, it is not always necessary for the rehabilitation of conveyance systems. However, farmer input is essential in preparing the general management and work plan.

2. The O&M procedures that will be implemented following rehabilitation should be determined as part of the overall management and work plan. Specific requirements of the operational plan which will effect water control must be included in the design criteria.

3. A delay in training the project O&M staff is likely to affect project success and hence they should be given the necessary training as early as possible. It is necessary to train the non-Irrigation Department personnel, particularly local officials and other influential individuals in the community, at an early stage. This would greatly help the acceptance of water management as a means of helping the farmers. It should have a long-term effect in maintaining the WUAs as viable organizations and may assist in their federation and the formation of an advisory committee to assist the project manager in setting policy.

The final official evaluation of the Gal Oya Left Bank Rehabilitation Project was conducted by the International Institute for Science and Technology (ISTI) in 1985. The evaluation methodology used in the investigation involved a review

of available documents and interviews with USAID and government officials as well as field visits.

The overall assessment of the project given in this report indicates that the project as a whole has been a success. The achievements listed are: 1) rehabilitation of a badly deteriorated major irrigation scheme in a cost-effective manner: 2) formation of viable farmers' organizations, which are functioning despite a fragmented social structure, 3) changes in agronomic practices, increased yields and increased cropping intensity, all due, at least partly, to improved water delivery and reliability.

Based on its findings, ISTI concluded that the project had substantially achieved its purpose of developing an institutional capability, which can be replicated to manage large irrigation schemes in Sri Lanka more efficiently and effectively with active farmer assistance. The report suggests that the methodology developed at Gal Oya needs to be extended to other schemes, with necessary adaptation to suit different physical and social environments.

Another important outcome of the project is the change in attitude, communication and behavior among fanners and govemment personnel that has occurred at Gal Oya (Merrey and Murray-Rust 1987). The factors that contributed to the overall project outcome, according to this review, are: 1) the improved reliability of water delivery as a result of rehabilitation: 2) the Institutional Organizer program and the farmers' organizations it created; 3) the leadership of the Range Deputy Director of Irrigation who actively promoted communication by direction and by example; and 4) the training program.

A review of the impact of the Gal Oya rehabilitation effort by Wijayaratne (1987) identifies the lessons applicable to future rehahilitation. It highlights the innovative and successful approaches used in various activities of the Gal Oya Project, and examines the constraints encountered and deficiencies observed in all stages of the project. This review suggests that the more significant constraints associated with the project were:

1. *Unrealistic assumptions during the planning phase.* One of the major expectations of the sponsoring agencies in regard to the proposed farmers' organizations was making fanners totally responsible for rehabilitation work of the field channels. However, farmers were never consulted about this in advance and no agreement was reached beforehand.

2. ***Weak or inadequate database.*** The project implementation, to a large extent, was affected by lack of data on vital aspects. The lengths of different categories of channels, and the extent of cultivated area were not known. There was inadequate information on drainage, reuse of water and soil characteristics.

3. ***Limited impact of rehabilitation on agricultural production.*** The direct influence of the rehabilitation program was limited to system-wide improvements in water availability. Therefore, in instances where factors other than irrigation water played a significant role in increasing production, the water management program alone was unlikely to provide solutions to the problems relating to production increases.

4. ***The use of original design specifications in rehabilitation.*** The initial objective was to restore the physical system to the original design specifications. However, this was not possible because the latter could not be found. Furthermore, some of the original specifications may not have been appropriate for the changed conditions of the project, as the actual command area had increased significantly over the past three decades. Rehabilitation should provide an opportunity to benefit from changes in technology that have occurred since the inception of a project and to adjust the system to emerging changes such as increased area, or new cropping patterns.

5. ***Poor coordination among line agencies.*** The work required by the local agencies (other than the Irrigation Department) to achieve the project objectives was not adequately defined in the project paper. In addition, lack of proper coordination and cooperation among agencies was observed to be a constraint during project implementation.

6. ***Limitations in benefit-cost evaluations of rehabilitation efforts.*** Calculations of benefits and costs in these studies (ex-ante and ex-post), depend on many assumptions such as the area that could be irrigated, the yields that could be obtained after the project is completed, the extent to which the benefits are correlated with project implementation, etc. The difficulties in projecting such information are rather well-known. Therefore, depending on the accuracy and the reality of underlying assumptions, the benefit-cost evaluations may vary greatly and could lead to misleading

results. For instance, the internal rate of return calculated for the Left Bank system rehabilitation varied from 47.4 percent (ISTI 1985) to 17 percent (ARTI evaluation).

Although a computer model for system operation has also been used for the purpose of enhancing the efficiency of water scheduling and to guide the operational decisions, it appears that this will not compensate for inadequate data on extents cultivated under different offtakes and on drainage.

SUSTAINABILITY OF THE PROJECT

As in the case of TIMP, research investigations have not been conducted after Gal Oya project completion to identify the project impact and the sustainability of the water management activities initiated by the project. A well-designed field research on this aspect is a critical need.

CHAPTER4

Major Irrigation Rehabilitation Project

THE MAJOR IRRIGATION Rehabilitation Project (MIRP) is funded by the World Bank (IDA) and co-financed hy the Canadian International Development Agency (CIDA) and the Swiss Development Corporation (SDC). Initially, the project was plannedtoheimplementedintheperiod 1985–90, but it was later extended to mid-1992. Theoriginal projectplans covered seven major irrigation systems: Kantale (6,990 ha), Mora Wewa (1,960 ha), Iranamadu (9,430 ha), Giant's Tank (12,460 ha), Rajangana (5,910 ha), Nachchaduwa (5,400 ha) and Huruluwewa (4,090 ha). The total project area is 46,240 ha. However, in threeoftheseschemes (Morawewa, Iranamaduand Giant's Tank), rehabilitation work wasnotundertaken due to civil disturbances.

PROJECT OBJECTIVES AND COMPONENTS

Similar to other rehabilitation projects, MIRP is primarily aimed at increasing agricultural production in the irrigation schemes mainly through improvements in water control and management. The specific activities of the project, as outlined in the appraisal report, are:

1. Rehabilitation of physical irrigation systems for optimum utilization of water.

2. Development of institutional organizations in each of the schemes.

3. Rehabilitation of roads and regularization of encroached lands.

4. Undertaking investigations on catchment management and socioeconomic studies.

5. Strengthening agricultural support services and input supply

In four of the schemes of MIRP, an experimental area covering about 150-200 ha per scheme has been identified to serve as a pilot program for testing selected technical options, mainly new types of irrigation structures for improving irrigation water control and delivery in the scheme. Another significant component of MIRP is to rehabilitate the lift irrigation system operating in the Rajangana Scheme by improving the channel system and providing new pump sets.

DEVELOPMENT STRATEGY

The development appmach adopted in MIRP involves: a) the rehabilitation of the irrigation conveyance system; b) the development of the institutional organizations; and c) the improvement of crop production in the schemes through the strengthening of input supply services.

Irrigation Development Strategy

Most of the rehabilitation work in MIRP appears to be centered on irrigation development, more specifically, on physical improvement of the channel system and the headworks. Large-scale adoption of lined rectangular channels with one cusec capacity was a major innovation planned initially in MIRP. However, the TIMP experience showed that under many circumstances, channels with one cusec capacity are likely to fail in delivering expected quantities of water. Therefore, this has not been attempted in MIRP. Instead, the channels have been designed to carry up to 2 cusecs, if all freeboard is used; lining is done only when needed and channels are made trapezoidal in cross section. not rectangular.

The intensity of construction activity was highest in the pilot, experimental area. This work mostly involved the installation of new, moderntypesofcontrol and measurement structures in two pilot distributaries.

Institutional Development Strategy

Unlike in the case of TIMP, the establishment of farmers' organizations has been considered a major development strategy of MIRP from its inception. As a step in this direction, MIRP funds have been used to strengthen the Irrigation Management Division (IMD) of the Ministry of Lands, Irrigation and Mahaweli Development. Institutional Organizers (IOs) whose task is to organize farmers into field-channel and distributary-channel groups have been employed as catalysts to involve farmers in rehabilitation and O&M work. The approach of utilizing the services of IOs is modeled on the Gal Oya Water Management Project and was based on the lessons learned from TIMP as well.

Crop Improvement Strategy

The approach adopted in MIRP differs sharply from that of TIMP. The practices of dry sowing and dry tillage have been completely given up. However, planting of short-duration varieties has been recommended during the dry season and attempts to achieve crop diversification in rice lands have been pursued. The MIRP development strategy does not emphasize the adoption of specific measures for improving agricultural activity in the project area.

PLANNING AND IMPLEMENTATION

Planning of MIRP has been influenced to a large extent by the experiences from TIMP and Gal Oya. Unlike TIMP, most of the planning and designing activities in MIRP have been undertaken on site. The irrigation schedules have been prepared to allow discharges that permit all gate operations during daylight hours. The installation of cross-regulators in MIRP has been a major benefit for water control in the main canals of the systems. Although TIMP relied very heavily on weir boxes for measurements at distributary-channel and field-channel levels, they were perceived by fanners as restricting flow and were, therefore, damaged by them. Learning from this experience, MIRP has installed broad-crested weirs which are more expensive, but durable.

In general, MIRP appears to reflect a relatively greater flexibility in preparing and implementing its rehabilitation plans. There is evidence to suggest that the plans have been changed subsequently to accommodate necessary modifications.

Howver, despite the existence of a higher degree of operational flexibility of MIRP when compared to TIMP, the available information also suggests that rehabilitation of most irrigation structures and canal layouts has followed a "blueprint approach" which is based on standard norms and guidelines; once drawn and decided, there is little room for any change.

Further, the rehabilitation plans of MIRP in the later years have not been able to benefit at all from the performance results of the "experimental" irrigation structures installed in the pilot areas. This again shows a rigidity of the implementational approach followed in MIRP.[1]

ORGANIZATION OF THE PROJECT

The executing agency of MIRP is the Irrigation Management Division (IMD) of the Ministry of Lands and Land Development, but all civil works are undertaken by the Irrigation Department. The project organization is also linked to the Integrated Management of Major Irrigation Systems (INMAS) Program. INMAS is a national program designed to meet the needs of integrated management, drawing upon the previous experiences in water management. Under INMAS, a project management committee comprising a project manager, farmer representatives and government officials from the line ministries is established at the project level. The project manager serves as the chairperson of the project committee and is responsible for coordinating the tasks relating to irrigation water management. The project management committee is supported by farmers' organizations at the distributary-channel and field-channel levels. An important component of this system of organization is the utilization of the services of the

[1] Recently, IIMI was invited to submit a proposal to evaluate these experiments, but it was too late then to obtain the full benefit of these pilot-area investments. Because of procedural delays and the high cost of the study, this activity was subsequently dropped.

Institutional Organizers (IOs), whose principal function is lo assist and develop the process ofestablishing viable farmers' organizations. TheIOs are administratively supervised by the project manager.

PROJECT COSTS

The project was estimated to cost about US$43.2 million (1984 currency). This included US$10.2 million for price escalation and US$ 2.6 million for taxes and duties (Table 4).

Table 4. Cost components of MIRP (in 1984 currency).

Item	Cost	
	(US$ M)	(%)
Civil works	30.2	69.9
Equipment and vehicles	8.4	19.5
Mechanical assistance	1.7	3.9
Engineering and administration	2.9	6.7
Total project cost	43.2	100.0

undertaken. A comprehensive evaluation of MIRP will require an analysis of the actual investments made in the various project components.

DATABASE FOR MEASURING PROJECT PERFORMANCE

Since MIRP is still an ongoing activity, relatively little information is available on the overall performance of the project, particularly the long-run trends. Some studies are underway to investigate particular aspects of project performance.

The main sources of information are those available in scattered documentary evidence from the Irrigation Department and other government departments, aides-memoir prepared by the donor agencies, and a consultancy report based on continuous monitoring and evaluation of MIRP (Agriswiss 1990).

The Agriswiss report provides a great deal of useful information based on field information and other data collected during the first two years of the project, from maha 1987/88 to yala 1989. The bulk of the findings in this report relates to the pilot areas chosen for intensive testing and improvement and, hence, may not reflect the overall picture. This study is continuing and will generate further data.

Another source that provides indirect information on the likely project outcome is a report prepared specifically to evaluate the results of adopting the INMAS approach to irrigation system development (ARTI 1989).

SUSTAINABILITY OF IRRIGATION IMPROVEMENT STRATEGIES

The Agriswiss report highlights the fact that from an irrigation development perspective, MIRP has suffered from a number of significaut problems during the project planning and design staged. These include:

1. Nonavailability of data required for designing canal layouts, preparing irrigation water delivery schedules, irrigable areas, etc.

2. Inadequate attention paid to the causes of earlier failures and deficiencies in irrigation schemes.

3. Rigid adherence to standard designs, leaving little room for adaptations that suit specific local situations.

4. Inflexibility of the scheme design process that does not allow changes in relation to actual needs in the system.

5. Very sophisticated and expensive control and measuring devices installed in the pilot area, which require higher levels of management and operational capabilities than can be expected at the farm level.

To the extent these observations are valid, it appears that despite the substantial efforts at rehabilitation and the operation of INMAS for a reasonably long period, the irrigation strategy is unlikely to deliver significant improvements in the long tun.

Data available in the Irrigation Department do not suggest encouraging development trends underlying MIRP. For instance, water consumption of rice in the individual irrigation schemes since the introduction of MIRP in 1985 has continued to show wide disparities within as well as between seasons. In the maha season, the water use for rice in Rajangana Scheme in 1985/86 amounted to 11.6 acre-feet (ac.ft.) while that in Huruluwewa Scheme during maha 1987/88 amounted only to 5.5 ac.ft. Similarly, in the yala season, Nachchaduwa Scheme has shown a water use of about 3.6 ac.ft. in 1987 while Rajangana Scheme has shown much higher level of 9.4 ac.ft. in 1988. Rajangana Scheme, in general, appears to consume very large amounts of water even after rehabilitation. In fact, it is reported that efforts by the project management to reduce water consumption have been largely rejected by farmers in the case of Rajangana Scheme.

The observed pattern of highly variable water consumption by rice cultivations in different schemes in MIRP is an issue that requires deeper attention. In fact, the reported data reflecting "'with project situation" suggest that there is no systematic relationship between waternse, crop area and crop yields. The reasons for such a situation could he many, but they must be studied.

Information contained in the Agriswiss report on the operating conditions of the irrigation networks in MIRP also indicates many operational and other problems in the project. In some channels, "the physical condition of the structures is poor and hence (they) are not ensuring proper water management." The report indicates the existence of substantial damages to the irrigation structures subsequent to rehabilitation. In regard to irrigation water distribution, the report points out instances in which irrigation schedules have not been prepared or farmers were not aware of such schedules. The farm surveys conducted in the pilot areas suggest that. at the field level, the water distribution system is not as systematic as expected. However, from this report, it is not clear whether such problems are common in all areas of the MIRP schemes. Nevertheless, the findings are useful in pointing out some of the poteutial problems that may affect the future returns of MIRP. It is important to recognize these problem and provide corrective measures at an early stage. Unfortunately, no serious attempts in this direction have been made so far.

AGRICULTURAL BENEFITS FROM MIRP

The performance indicators relating to agriculture in the project area during the past few years such as cropped area, cultivation intensity, crop yield, and shift towards high-value crops do not indicate encouraging changes. Despite high expectations of the project to achieve higher cropping intensities, the actual accomplishments during the initial five years are unsatisfactory. Similarly, data also show that although the area cultivated in *the maha* season is generally stable, the area cultivated in yala is still highly variable.

The crop yields in the MIRP schemes too have shown wide variations. Despite the efforts made by MIRP and INMAS, rice yields in the schemes during the period 1985–91 have not shown sustained increases, suggesting that the crop yields are determined by many factors outside water management. (Such a yield stagnation is a common feature in most irrigation schemes in Sri Lanka.)

Two important factors that determine the area cultivated and crop yields in the MIRP schemes are the amount of water received from Mahaweli through the feeder channels, and its timeliness. Reports indicate that Mahaweli water supplies have been highly variable and have not been sufficient to match the

rainfall deficiencies. Thus, there is an urgent need to review the allocation of water from Mahaweli to these systems to stabilize both yala and maha crops.

Except in a few isolated instances, cropdiversificationdoesnot seem to have achieved much sustained success in MIRP.

Data on agricultural productionin theindividnalschemes suggestthatitismost unlikely that the project would make significant headway in achieving its high production targets. The problem is partly due lo the influence of a range of constraints outside irrigation water supply and distribution, in areas such as marketing, generation and dissemination of research results, and institutional performance.

PROJECT INFLUENCES ON ORGANIZATIONAL ASPECTS

So far, the performance of MIRP has not been a subject of investigation from a management/organizational perspective. However, the study by ARTI in 1988 (ARTI 1989), which evaluated the performance of the INMAS Program, including a wide range of irrigation systems outside MIRP, provides some indirect information. The study specifically focuses on the project manager's role in coordinating activities of the line agencies operating within the irrigation systems. Findings of this study indicate many potential problems that are likely to reduce the efficiency of the project manager. Among the many problems highlighted, the more important are the lack of coordination of activities by line agencies. and the lack of authority of the Project Manager over other officers.

According to the ARTI investigation, in some schemes, the absence of speedy responses froni the project management to specific problems of the farmers has led to a distancing of Ihe farmers and the project managers. The study also indicates that Institutional Organizers, whose role is to act as catalysts in the establishment of farmers' organizations, are often constrained in performing their expected tasks due to problems such as undue political pressures affecting the formation of farmers' organizations and selection of farmer representatives, conflicts of interests between and within organizations and by a misperception of the farmers on their role. Thus, the experiences in MIRP so far indicate that in the initial period of its implementation, the project has replicated many problems and weaknesses displayed in earlier rehabilitation projects.

FEEDBACK OF RESEARCH INFORMATION INTO THE PROJECT

One of the major aim of establishing the pilot areas in the MIRP irrigation systems has been to utilize these areas for experimentation with the hope of using the experimental results for further improvements in other areas. With this end in view, substantial efforts have been made to install structures with improved designs and to carry out other related activities. Similarly, monitoring the activities in the pilot areas and the control area also has not taken place as originally planned. The project, at the beginning, aimed at designing computer-aided hydrological models for planning issues of water to the distributary channels. The outcome of this exercise too has not been encouraging. The model is operative only in Nachchaduwa Scheme, but even in this case the results generated by the model are significantly different from actual water discharges. This suggests the need to improve the model as well as the underlying parameters. It appears that the Irrigation Department has not contemplated the possibility of introducing the type of control structures in the pilot areas to other areas mainly because of cost considerations.

The overall situation in the MIRP schemes with respect to the use of feedback information, therefore, suggests that opportunities for improvements have not been adequately used so far.

CHAPTER 5

Uda Walawe Rehabilitation Project

THE UDA WALAWE Irrigation Scheme, located in the southem dry zone of Sri Lanka, was initiated in the 1960s. The total command area of the project is about 17,000 ha. The rehabilitation work was begun in **1985** with funding from the Asian Development Bank (ADB). It is now expected to be completed in 1993. This work is being implemented only in the right bank, with a command area of about 12,000 ha. It is important to note that unlike the other projects reviewed here, Walawe is managed by the Mahaweli Authority of Sri Lanka (MASL).

BASIS OF SELECTION FOR REHABILITATION AND PROBLEMS

In the 1980s, the Uda Walawe Irrigation Scheme received increasing attention mainly because of its poor performance in realizing the original project targets. Although a rehabilitation and development project, with the assistance of ADB, **was** implemented in the 1970s, the project failed to achieve its objectives. Subsequently, in the mid-1980s, a feasibility study for rehahilitating the system under a new project was undertaken by SOGREAH (1985).

The feasibility report identified that most irrigation-related problems in the Uda Walawe Irrigation Scheme arise basically from excessive water use and wastage in the head-end blocks. Some of the specific problems mentioned in the report are: inefficient on-farm water use resulting from cultivation of rice in permeable soils, excessive conveyance losses, inequity of water distribution, faulty design and poor control structures, and poor operation and maintenance of the conveyance system.

PROJECT OBJECTIVE

The primary objective of the rehabilitation project is to improve the irrigation water use efficiency in the scheme mainly through reducing conveyance losses and improving water control and delivery facilities.

DEVELOPMENT STRATEGY

The specific approaches adopted by therehahilitation project can besummarized as follows:

1. Physical improvements in the conveyance system, including rehabilitation of structuraldefects in the main system and the branchcanal system.

2. Improvements in the water distribution system through rehabilitation of the distributary-channel and field-channel systems, including the installation of one-cusec field channels parallel to the distributary channel.

3. Improvement of O&M activities

4. Rehabilitationof roads.

5. Improvement of domestic watersupply by providing wells.

6. Provisionofequipmentandvehicles.

The development approach adopted in the project generally reflects a heavy emphasis on improving physical infrastructure.

ASSUMPTIONS UNDERLYING THE DEVELOPMENT APPROACH

The development strategy of the Uda Walawe Project appears to be based on the principal assumption that the primary constraint affecting the farm output in the project area is the inadequacy and ineffective use of irrigation water due to the poor physical status of the project: once the water conveyance system is improved, resource productivity and total output of the project would be enhanced.

In developing the project development strategy, it is recognized that rice cultivation would remain as the dominant crop in most of the project area in the future. Yields of rice in the Uda Walawe Project, particularly in the upper reaches, are already close to the maximum potential achievable under current production technology. Hence, no improvements in rice yields in this area are envisaged. However, there is scope for increasing yields in the tail end of the project area by improving irrigation water use efficiency.

PLANNING PROCESS AND IMPLEMENTATION

Very little information regarding the nature of the planning process adopted in Uda Walawe is available. However, the preparation of project development plans reflects a strong top-down approach, with a bias towards construction and other capital-intensive activities. The project development plans have been made at the center, with little information from and participation of those at the project and field levels.

The implementation of the project has fallen far behind schedule and it is now expected to be completed in 1993. The delay is attributed to a number of problems, most of which are related to administrative factors such as lack of sufficient staff, ineffective communication and an unsatisfactory security situation. However, studies conducted by IIMI indicate that the basic problems affecting the project stem from management and organizational issues (IIMI 1990).

PROJECT ORGANIZATION

The information on the organizational structure indicates that until recently most of the major decisions regarding project operation and maintenance activities were made outside the project, in Colombo, with little or no input from the project beneficiaries. As a result, farmers in the project have become passive receivers of the improvement package. Furthermore, the management style adopted in the project largely reflects a rigid pattern, with little flexibility to change and respond to specific beneficiary needs.

However, the nature of the project organization changed substantially with the reformulation of the project in 1990 (IIMI 1990). These changes have facilitated the incorporation of the needs of the farmers as well as of the officials in the scheme regarding the type and nature of improvements they require.

PROJECT COSTS AND COMPONENTS

Little information on costs of the rehabilitation is available, other than the planned expenditure. Nearly 90 percent of the allocated funds for rehabilitation is reported to be earmarked for civil works and equipment (IIMI 1990). Since the project implementation has been delayed substantially, project costs have now nearly doubled.

The appraisal report prepared by SOGREAH (1985) estimated that the rehabilitation cost would be less than US$1,000 per ha and that the internal rate of return to the rehabilitation investment would be about 35 percent (Table 5). The report, however, provides no indication as to how these estimates were derived.

It is significant to note that activities such as training farmers, farmer leaders and others connected with developing farmers' organizations received virtually no attention in the original project formulation.

Table 5. Cost composition of the Uda Walawe Rehabilitation Project (in 1985 currency).

Item	cost	
	(US$'000)	(%)
Irrigation system improvement	14,669	66.4
Road rehabilitation	612	2.8
Domestic water supply	709	3.2
Equipment and vehicles	850	3.8
Adaptive research	86	0.4
Consultancy services and training	1,472	6.6
administration (CECB)	3,314	15.1
Service charge and others	374	1.7
Total	22,086	100.0

Source: Project appraisal report prepared by SOGREAH 1985.

LIKELY IMPACT OF THE PROJECT

Since the project is currently being implemented and considerable work is still to be done, it is rather premature to draw conclusions on the possible project outcomes, Furthermore, studies on the project performance are limited. The studies conducted by IIMI comprise a significant contribution in this regard. IIMI investigations are of a long-term nature, and Phase I has been completed. Phase II of the IIMI studies is currently underway. IIMI studies are based on detailed data collected at the farm and system levels over a period of four cultivation seasons extending from 1987 to 1989. Information has been gathered from sample study sites in the project area. Results of these studies provide valuable insights regarding the likely impact of the project. It is significant to note that the project was reformulated on the basis of the recommendations emerging from the IIMI studies.

An assessment of the overall performance of the rehabilitation project suggests that due to many problems, the project has so far shown little success. The project implementation has run into major delays and cost overruns. One of the major problems that has led to this unsatisfactory outcome is that the project, in general, bas been conceived mainly as a construction-oriented

investment, with little or no effort to diagnose actual problems faced by farmers and prescribe solutions to them.

A major recommendation emerging from the IIMI studies is that if the project is to show successful results, the project design and formulation should undergo drastic changes. The IIMI studies point out that heavy emphasis has been placed on construction activity, but the project implementors have not given much attention to farmers' organizations, training, research, and feedback mechanisms.

In order to remedy these complex problems, many suggestions have been made. Among them, the most significant is the introduction of a participatory approach to irrigation water management that would emphasize farmer needs and aspirations. It has also been suggested that the existing, centrally controlled system of project management needs to be replaced with a new system in which officials in the project are given autonomy to take decisions in close consultation with farmers.

As a preliminary step to increasing farmer involvement in system management, the IIMI studies suggest that it would be necessary to repair the main canals and the distributary channels as early as possible. The rationale for this is that unless a reasonably good main canal and branch canal conveyance system is first established, it is difficult to seek farmer participation for undertaking O&M of the system.

The overall strategy proposed in the IIMI studies consists of three main approaches involving institutional, irrigation and agricultural development. The institutional development activity provides a new dimension to the development strategies followed so far in Uda Walawe. Far-reaching recommendations have been suggested to achieve greater farmer participation in system management and operation. The irrigation development strategy involves repairs to the conveyance system which is now in a dilapidated situation. As a means of seeking farmer cooperation, it is suggested that there should be a concerted effort to utilize their labor to do essential repairs to field channels prior to formal rehabilitation.

The agricultural development strategy involves a move towards crop diversification in areas where water availability is inadequate for rice. In view of the favorable agro-climatic features, Uda Walawe Scheme has a distinct comparative advantage for rice cultivation. Therefore, the choice of alternative crops that could be grown in the project area is limited and the IIMI studies suggest that rice production at the head end of the system should not be reduced in the short-to medium-term by pressure on the farmers but that farmers at the tail end should be encouraged to diversify.

MASL has been implementing some of the recommendations proposed by IIMI. Under the second phase of the IIMI studies, IIMI is assisting project officials and farmers to test and implement some management innovations. It is too early to judge the outcome of these efforts.

CHAPTER 6

Irrigation Systems Management Project

Scheme	Area (ha)
Gal Oya: Left Bank	26.316
Right Bank	12.955
Pardkrama Samudra	9,716
Giritale	3,036
Minneriya	8,927
Kaudulla	12,955
Ridi Bendi Ela	2,632
Total	76,537

Source: USAID 1986.

PROJECT OBJECTIVES

In addition to the rehabilitation of the above schemes, the project, in broader terms, aims at developing the national institutional capacity to manage and operate major irrigation systems and to establish strong farmers' organizations that are capable of catering to the demands in the irrigation sector.

PLANNING AND ASSUMPTIONS

ISMP is based on the concepts of the Gal Oya Water Management Project and the lessons learned from it. Thus, as in the case of Gal Oya, a high degree of management orientation is a key feature in the ISMP plans.

The project activities are mobilized mostly through the INMAS (Integrated Management for Major Irrigation Schemes) Program, launched in 1984 to provide a solution for the low productivity in major agricultural settlements outside the Mahaweli System.

An implicit assumption underlying the project design appears to be that the relatively low productivity in the irrigation schemes is mainly due to institutional and managerial problems, particularly the lack of farmer participation and other "software" problems affecting the irrigation settlement schemes.

PROJECT ORGANIZATION

Basically, the project is organized for activities at two levels, national and local. At the national level, the organization is designed to improve institutional capacity and, thus, the financial management in irrigation systems and also to upgrade such water-management-related activities such as training, research, evaluation and monitoring. At the local level, the project is mainly engaged in improving selected schemes that can be used to test new approaches to improving water management activities.

The development strategies of ISMP are implemented in the irrigation schemes through the Project Management Committee (PMC) system. This system is composed of a project manager, farmer representatives and officials in the line agencies serving the direct and indirect agricultural needs of the scheme. At the local level, farmers' organizations are utilized to mobilize farmer participation in operation and maintenance activities. The PMC, therefore, is expected to represent fanner interests, with the responsibility of ensuring overall supervision. This design of the organizational structure is based on the experiences gained from previous rehabilitation projects, particularly, the Gal Oya Project.

The project manager's main task is to coordinate activities at the scheme level. Institutional Organizers (IOs), functioning under the broad supervision of project managers, have been appointed at the scheme level. The IOs are, basically, expected to play the role of catalysts in mobilizing farmer participation for O&M activities. The project managers as well as 10 s are provided with intensive job-oriented training on a wide range of activities.

PROJECT COMPONENTS AND COSTS

ISMP consists of six major components:

1. Establishment and strengthening of farmers' organizations.
2. Improvement of operation and maintenance of irrigation systems
3. Enhancing financial management capahilities of fannersandothers who are dealing with O&M fees and other sources of funds.
4. Monitoring and evaluation of project activities and feedback.
5. Enhancing training capacity
6. **Appliedresearchintotheworkingoftheprnjectwithaviewtoproviding** feedbackinformation and improved guidelines.

Project costing for rehabilitation was based on two major concepts: Essential Structural Improvement (ESI) and Pragmatic Rehabilitation. These two concepts

are defined as two methods of improving an existing irrigation system to an acceptable functional level using cost-effective and economic methods. The project paper explains that the difference between the two approaches relates to the financial input into the improvement. For instance, in ESI, the O&M staff are utilized throughout, whereas Pragmatic Rehabilitation involves temporary design and construction staff to carry out rehabilitation works.

The project, estimated to cost about US$28.3 million in 1985 currency, is funded by USAID (USAID 1986). The funds include a foreign contribution of US$ 18.6 million (66%) consisting of a grant of US$6.9 million and a loan of US$11.7 million, The local contribution is estimated at US$9.7 million (34%). A summary of the project-cost composition is given in Table 7.

Table 7. Cost composition of ISMP (in 1985 currency).

Item	C	
	(US$'000)	(%)
Technical assistance	4,590	16.2
Commodities	4,865	17.2
Training	1,140	4.0
Facilities (construction)	330	1.2
Rehabilitation (construction)	11,830	41.8
Research/studies	540	1.9
GSL personnel	4,490	15.9
GSL personnel (IOs)	380	1.3
Evaluation	135	0.5
Total	**28,300**	100.0

Source: USAID 1986.

According to the original project plans prepared in 1984/85, the estimated cost of system rehabilitation was around Rs4,446/ha for Essential Structural Improvements (ESI) and Rs6,175/ha for Pragmatic Rehabilitation, which values are equivalent to US$170/ha and US$237/ha, respectively, at the exchange rates prevailing in 1985 (USAID 1986).

LIKELY OUTCOME OF THE PROJECT

Compared to the other projects, ISMP has been in operation for a relatively short period and less information is available on its overall performance. However, from the information generated so far, it is clear that ISMP has played a largely complementary role to most other rehabilitation activities.

Because of its wide-ranging objectives, focused on a management orientation, a comprehensive evaluation of the performance and output of ISMP is a complex task. The project is mainly aimed at strengthening and expanding the farm-level and system-level institutions in the irrigation systems concerned. Hence, one of the possible approaches to evaluating the likely outcome of the project and its sustainahility may relate to these institutions. Unfortunately, not much research into this issue has been undertaken so far.

Much of the existing literature pertaining to ISMP input/output activity is related to institutional development. Information on other aspects such as agricultural, irrigation, income and employment consequences of the project is not available, except for a review of existing data completed recently (AICS 1991).

A useful source of information regarding the performance of ISMP in its early stages is the mid-term review (ISPAN 1990a). The main goal of this report was to review the progress made since 1987, identify challenges and opportunities for the remainder of the project period and to highlight the more critical needs to be addressed. As an integral part of the evaluation. a review workshop was also conducted to assist the participating agencies in forward planning to implement the remainder of the project more effectively (ISPAN 1990b). The more important issues reviewed in this evaluation report are centered on a number of issues: overall policy implications of ISMP, farmers' organizations, training enhancement, operation and maintenance, financial management, research, monitoring, evaluation and feedback.

In assessing project progress, the mid-term evaluation has placed a special emphasis on the institutional development and sustainability aspects of the project. The evaluation has concluded that ISMP is a useful learning experiment with considerable potential impact on the future of irrigation systems management in Sri Lanka. The report states that ISMP has been instrumental in creating a clear recognition among officials that farmers must play a substantial role in irrigation system development and management. The evaluation concludes that ISMP has been instrumental in strengthening government conimitment to increasing farmer participation in decision making and planning, in integrating technical

and institutional development and in institutionalizing participatory management.

Two more sources of information that throw useful indirect insights into the institutional development aspects of ISMP are a study report prepared by TEAMS (1990) on ISMP and a report prepared by ARTI (1989) on INMAS.

The TEAMS report specifically focuses on the performance of the institutional aspects of four of the ISMP schemes in Polonnaruwa District: Parakrama Samudra, Giritale, Minneriya and Kaudulla. Because of the apparent superiority of the institutional strength of the farmers' organizations in Ridi Bendi Ela Scheme, the study also places a special emphasis on investigating the actual performance of this scheme to identify any lessons that could be leamt. The report covers a wide range of issues relating to the establishment and functioning of fanners' organizations in the schemes studied, using descriptive information. The study notes a wide variability of the efficiency of functioning of these institutions in the schemes.

The ARTI study, mentioned earlier in Chapter 4 on MIRP, on the other hand, is not specifically designed to focus only on the schemes covered by ISMP. The study is based on data from 41 irrigation schemes in the INMAS Program including three of the ISMP irrigation schemes: Parakrama Samudra, Kaudulla, Ridi Bendi Ela (ARTI 1989). The study was conducted at an early stage of ISMP and, hence, suffers the disadvantage of partial coverage of the project activities. Despite such broad limitations, the findings of this study provide critical insights that would also shed some light into the functioning of local institutions in the ISMP schemes.

The ARTI study highlights many potential problem that may weaken the project management system. These include problems such as the lack of authority of the project manager over officers in other line agencies and lack of cooperation from officials in the line agencies.

AGRICULTURAL IMPLICATIONS OF ISMP

As in most other rehabilitation programmes, only a few attempts have been made to conduct investigations designed to analyze and establish the performance of ISMP in relation to agricultural production and related issues. Some attempts have been made in this regard recently (AICS 1991).

The AICS report is basically a literature survey based on a range of secondary data sources such as the Departments of Agriculture, Census and Statistics, and Irrigation, as well as some published documents concerning the ISMP schemes in Polonnaruwa. The study attempts to synthesize the large volume of data available on crop yields, area cultivated and other related information in various institutions season by season with a view to evaluating the performance of ISMP schemes in Polonnaruwa. The report highlights that agricultural productivity has stagnated in the schemes concerned. The study notes that there are substantial differences in productivity between and within schemes. Although it would be useful to examine the sources of such variability and the resulting fanner welfare implications, no attempts have been made so far to undertake such investigations.

OUTPUT OF ISMP-SPONSORED RESEARCH

From an overall perspective, it appears that one of the more useful outcomes of ISMP relates to the generation of research interest in the irrigation sector. The initiative has already led to the completion of a number of research investigations of local interest on areas such as low-cost rehabilitation, flow measurements, O&M costs and institution building. The research activities sponsored by ISMP are mobilized through the Project Research Advisory Committee. Although much work has to be done in the field of research on irrigation system rehabilitation and improvement, the impetus already given to this activity hy ISMP is commendable.

PART 3

CHAPTER 7

Experiences and Lessons Learned

THE IMPLEMENTATION OF a number of irrigation rehabilitation projects since the 1970s has generated a variety of policy-relevant experiences and lessons on a wide range of issues. The identification of such lessons is, therefore, a crucial step in avoiding a recurrence of past mistakes and also in protecting future investments in irrigation rehabilitation. The more significant experiences gained and lessons learned are highlighted in this chapter. The discussion is structured under the following themes:

1. Need for pursuing low-cost rehabilitation options
2. Management orientation as an effective means of improving viabiity of irrigation rehabilitation projects.
3. Role of participatory approach for achieving project success.
4. Farmers' organizations (FOs) which form an indispensable means of mobilizing farmer participation and local resources for irrigation rehabilitation.
5. Significance of non-water factors in determining the overall success of irrigation systems.
6. Need for securing a reliable information base prior to designing the rehabilitation project.
7. Need to incorporate farmers' knowledge and experiences
8. Critical role played by new agricultural and irrigation technologies in improving irrigation system performance.

NEED FOX SEEKING LOW-COST REHABILITATION OPTIONS

As demonstrated in this literature survey, research investigations specifically aimed at analyzing costs of rehabilitation projects are lacking in Sri Lanka. However, from the scattered evidence available on this issue, it is clear that the cost intensity of various rehabilitation projects has varied widely, depending on the strategies adopted.

From the available data, it is clear that in schemes where the capital intensity ofrehabilitation isextremely high, the high cost may even threaten theeconomic viability of the project (see also Aluvihare and Kikuchi 199l).

From the point of view of marginal benefits that would accrue to the investments in rehabilitation projects, the past performance record provides interesting but not encouraging lessons. In general, the evidence available so far seems to supporttheview that the outputeffects ofrehabilitation, in terms of enhancedcrop yields, increasedcroppingintensity and the shift towards crop diversification have been rather poor. There is no definite information, as yet, lo test the hypothesis thatirrigation rehabilitation has led tosignificant increasesin total crop production.

From the available information, it may be surmised that returns to investments in irrigation system rehabilitation were obtained through the prevention of potential reduction in cultivated area, crop yields and production which would have occurred if rehabilitation had not been carried out. It ismostlikely that the rehabilitation investments would also have brought about greater stability and equity to agricultural production within the scheme. Unfortunately, even in this instance, there is no evidence to arrive at a firmconclusion

NEED FOX MANAGEMENT ORIENTATION TO REHABILITATION PROJECTS

In the early period of irrigation sector development in Sri Lanka, that is, prior to the 1970s, rehabilitation work was conceived only in terms of physical construction. However, it is now firmlyestablished that management is an indispensable ingredient for achieving higherefficiency and sustainability of irrigation system rehabilitation.

Availableinfortnation, in general, suggests that physical improvements of an irrigation system alone are unlikely to generate high rates of return, unless complemented with a strong management component. For instance, it has been shownthat in thecaseof the Gal Oyalmgation Water Management Project, where management improvement was given emphasis, the rate of return to investment has been remarkably high, almost equal to that of new irrigation investment projects initiated in the 1950s (Table 8). Results given in Table 8 show that the twomajorrehabilitation projects, Gal Oya and TIMP, showratesofreturnshigher thanthose for new construction. These data also show that in water management projects such as Kimbulwana Oya and Pimburattewa, with modest construction investments, the returns could be substantially high.

Table 8. Rates of return on irrigation investments in the 1980s, by type of investment, basedon 1986 price estimates.

Type of investment	B/C ratio	Internal rate of return (%)
I. New Construction' Projects	0.8	9
II. Major Rehabilitation Projects		
TIMP[b]	1.1	11
Gal Oya	2.3	24
111. Water Management Projects		
Kimbulwana Oya	13.4	83
Pimburattewa	7.4	77
Nagadeepa	0.4	6

Although it is unwise to generalize on the basis of these results alone, the findings, in general, suggest that in terms of maximizing returns to investment, there is much scope for pursuing alternative strategies of irrigation system rehabilitation. From the evidence so far gathered, it appears reasonable to conclude that minor physical improvements accompanied by water management and institution building activities are most likely to lead to high rates of return on investnients in irrigation rehabilitation projects; but a strong emphasis on highly capital-intensive construction along with less emphasis on management improvements is likely to result in poor economic rates of return on the investment.

ROLE OF PARTICIPATORY APPROACH IN IRRIGATION REHABILITATION

Since the late 1970s, the thrust of irrigation rehabilitation has undergone a major transformation in terms of the relative emphasis placed on farmer panicipation. Previously, the task of rehabilitating irrigation systems was generally perceived as a task solely involving engiueers and government administrative actions. This process essentially reflected a top-down approach, in which the beneficiaries were considered as passive receivers of rehabilitation benefits. Under such situations the system management staff and policymakers did not recognize the possibility that farmers could play a useful role in managing their own irrigation systems.

Lessons from all rehabilitation exercises so far undertaken have clearly shown that effective user participation is a fundamental component in determining the success or failure of the projects. Experiences have repeatedly proved that farmer participation is feasible and is advantageous whenever applied.

Aspects of the dynamics of involving farmers in system rehabilitation and O&M work are yet to be understood. It appears that a participatory model successfully adopted in one location cannot be easily replicated elsewhere in the same fashion, with the same degree of success.

The review reflects that the development strategies adopted on past rehabilitation projects have been hased on two majortypes of rehabilitation models. One is represented by TIMP and Uda Walawe (rehabilitation projects), with a heavy bias towards construction-oriented solutions for improving the water conveyance and distribution problems (hardware approach). The second type is represented

by Gal Oya and ISMP, illustrating a heavy emphasis placed on user participation and management-intensive activity (software approach).

The results of rehabilitation projects also suggest that there are significant trade-offs between the hardware approach and software approach. The adoption of a single approach alone is unlikely to generate an adequate response.

The hardware approach, in general, is more capital-intensive, involves the use of relatively more sophisticated management systems than are usually found at the farmer level, demands a greater degree of central control, and is less economically viable. This type of system tends to fail more easily under conditions of low water availability as was seen in TIMP, as well as, apparently, under conditions of high water availability, as is seen in Walawe.

The software approach, however, appears to be potentially more profitable and sustainable in the long run. It is usually less capital-intensive and more management-intensive. This system does not require high levels of managerial skills to operate. A major advantage in this approach is that the system is more flexible and more efficient even under low water availability situations.

However, it appears that some form of initial physical rehabilitation is a prerequisite for mobilization and to sustenance of farmer participation, particularly, when the conveyance system is in an advanced state of deterioration. Under such situations, it may be necessary to provide some improvement to the physical condition of the system mainly to stimulate farmer participation. Experience also suggests that achieving a high degree of success in promoting farmer participation is a difficult and time-consuming challenge, but with potentially high payoffs.

Another major lesson in this regard is that the involvement of farmers in the rehabilitation process should be sought from the very inception. i.e., from the time of identification of the project. Numerous instances in which the arrangements to seek fanner involvement at later stages of project development have miserably failed. are seen in the literature. Implementation of a rigid plan prepared at the center with little involvement at the local level has, usually, led to non acceptance by fanners.

These lessons imply that for better returns from rehabilitation. high priority should be given to institution development, both at the farm level and at the project level. Necessary staff and financial support must be provided for ongoing training and technical assistance and for closely monitoring the institutions that are created.

FARMERS' ORGANIZATIONS AS A VEHICLE FOR MOBILIZING FARMER PARTICIPATION

Effective utilization of physical improvements can only be made in rehabilitation projects with strong, farmer-centered institutions. Lessons learned so far indicate that the development of sustainable farmers' organizations (FOs) should basically follow a bottom-up approach. There is evidence to suggest that the viability of FOs is dependent on many factors. It is suggested that FOs built around hydrological boundaries are more stable. In larger schemes, a hierarchy of federations of FOs would be needed. Provision of appropriate training for farmers and others who are involved in organizing fanners and the establishment of a proper legal environment for them to operate are also indicated as vital factors.

Past experiences clearly suggest that the employment of specially trained catalyst agents, i.e., Institutional Organizers (IOs), is a useful approach to developing FOs. With some changes and adaptations, the approach of employing catalysts as in Gal Oya has been replicated elsewhere on a broader scale. This approach has also been identified as a strategy in the proposed National Irrigation Rehabilitation Project (NIRP).

However, experiences in Gal Oya also suggest the recruiting of IOs with high educational qualifications from outside areas leads to major difficulties in regard to the sustainability of their services. Despite intensive training given to them at high cost, there was a rapid turnover of IOs in the Gal Oya project. Therefore, it is now recognized that the IOs should be recruited within the area itself and that graduates are not essential to play the role of catalysts. Similarly, it seems to be generally accepted that the permanency of employment offered to the IOs could eventually lead to many problems. In particular, it may lead to a dependency syndrome of the farmers. Mainly because of this, it has been generally accepted that IOs should be appointed on a temporary basis.

INFLUENCE OF NON-WATER FACTORS ON SYSTEM PERFORMANCE

This review has suggested that an implicit assumption underlying the design and implementation of most irrigation rehabilitation works is that irrigation water is

the important factor that limits agricultural production expansion in the dry zone. Although this assumption may be valid for some irrigation schemes, it does not hold true equally for all irrigation schemes.

In general, there is a large body of evidence suggesting the need to recognize that focusing on improvement of irrigation water management activities alone is unlikely to provide large benefits on a sustained basis. A narrow development focus, aimed solely on irrigation water management and distribution would not deliver expectations in the long run.

Numerous studies on the performance of irrigation settlement schemes show that the level of production in irrigation systems is influenced by a range of variables, including those within as well as outside the farm and biological, economical, social and institutional factors. Some of the more important non-water factors that frequently surface in irrigation and related literature are the nonavailability of alternative agricultural production technologies, poor information dissemination, and weak credit, marketing and extension facilities.

The lack of suitable agricultural technology relating to crop varieties, cultivation methods, harvesting and processing methodologies is a major bottleneck in improving irrigation systems. The first attempt to recognize the usefulness of harnessing agricultural technology to increase land use intensity and crop production in an irrigation system was seen in the case of TIMP. Since then. no significant attempt has been made to improve agricultural technologies.

In many irrigation schemes, the development of the agricultural system is constrained by factors outside the control of the scheme. Some of these external factors are inappropriate trade and import policies. poor pricing mechanisms and producer incentives, weak extension, and weak adaptive research programs.

The literature survey also shows that in many irrigation systems, problems such as land fragmentation, absentee landownership and tenancy agreements are leading to inefficient resources management and low productivity. In most rehabilitated projects, these problems, though significant, are hidden. Such hidden tenancy agreements appear to have led to major transfers of land operational rights in most older irrigation systems. Such problems may have significant implications for effective management of irrigation water at the system level, as well as for the viability of the fanners' organizations.

NEED FOR ADEQUATE INFORMATION PRIOR TO REHABILITATION

Most failures of rehabilitation projects can be traced to poor information or its nonavailability on actual operations and problems of the system.

Information gathered in this study shows that the designs of rehabilitation programs in Sri Lanka are often based on relatively narrow sets of data regarding the actual field problems in the schemes. Insufficient attention given to this aspect has resulted in a mis-diagnosis of the problems affecting the agricultural systems in the irrigation schemes and their beneficiaries. A major means of correcting problems resulting from unrealistic data and assumptions made during the planning and design phase is to use a properly designed and executed mid-tern evaluation. This approach enables the project planners to adopt appropriate mid-course corrections and to redirect a rehabilitation effort before the project works are over. The usefulness of this strategy has been clearly demonstrated, particularly in Gal Oya and Walawe projects.

The need to appreciate the existing patterns of water allocation and distribution and their organizational basis has been shown in many rehahilitation projects. Often the strength of the systems lies in an established pattern of water distribution, with strong norms and rules dictating the behavior of water users. A superficial investigation may suggest the systems are wasting water and fanners are appropriating water at their will, when the actual situation is not so.

NEED TO INCORPORATE FARMERS' KNOWLEDGE AND EXPERIENCES

The studies also show that there is a critical need to incorporate farmers' knowledge and experiences in designing new rehabilitation schemes. Farmers, by virtue of their long association with fanning, have accumulated a wealth of practical knowledge. This knowledge is a vital resource for identifying specific improvement strategies. Provision of new agricultural production techniques to farmers also needs to be an integral part of a project. These new techniques need to be adaptable to the specific climatic and other production conditions in the area. Farmers, particularly in areas associated with a high risk of crop losses, have adjusted their farming systems and resource use patterns to suit their environ-

ments. Thus, unless their living environment is properly studied from a long-term perspective. it is difficult to ascertain the critical problems faced by them.

NEED TO INTRODUCE IMPROVED AGRICULTURAL AND IRRIGATION TECHNOLOGIES

There is ample evidence to suggest that the long-run solution to increasing production and productivity lies in introducing new technologies. The study by Aluvihare and Kikuchi (1991) states that "Returns to investment on new irrigation schemes were high initially and sustained throughout in the subsequent periods by seed/fertilizer revolutions introduced in the 1960s. Without such technological change, the economic potentials of many of the irrigation schemes would have been exhausted."

In the case of agriculture, there is a need for pursuing alternative technologies of crop production under irrigation and to move away from the traditional system of double cropping of rice under gravity flow irrigation method. Technological improvements such as new types of crops. and new genetic varieties of crops, new and less-costly methods of crop cultivation, etc., in the agricultural production sector cannot be introduced overnight, but require long-term adaptive research.

The information gathered from the various irrigation projects suggests that standard approaches to designing irrigation projects may not be appropriate for some rehabilitation projects. Therefore, innovative engineering methods for rehabilitation are required. Until recently, it appears that most of the rehabilitation projects tended to follow traditional designs. What is needed is to undertake research studies on alternative designs and engineering methods. This would provide a strong database that would allow a choice among the possible options. Currently, such research activities are hardly undertaken. Even in the limited instances where such information is available, not much effort has been made to bring them into wider circulation, perhaps because of a lack of suitable mechanisms to do so.

It also appears that due to lack of site-specific engineering and other technical information, most of the systems are designed on the basis of parameters that may not be relevant for the given situations. Frequently, irrigation design engineers seem to be facing a lack of basic information regarding actual field situations.

Under such circumstances better data availability could improve design activities.

Whenever local data availability is a major constraint, farmer involvement in the design process through appropriate mechanisms is likely to improve the quality of rehabilitation work. Farmers, through their experiences gained by living in the area for long periods, could contribute a lot to the design process. The use of such a design approach can also lead to farmers taking greater responsibility for system O&M after rehabilitation.

CHAPTER 8

Research Issues for Further Investigations

THE REVIEW OF irrigation rehabilitation projects presented in the previous chapters clearly illustrates that, although in the past two decades Sri Lanka has witnessed a rapid growth in irrigation rehabilitation investments, its research activities relating to irrigation sector development have not shown a significant expansion. Mainly because of this lag in research activity, much of the crucial information needed for planning and implementing irrigation rehabilitation projects is currently not available to the decision makers. The paucity of research data is a fundamental problem affecting the efficiency of the irrigation rehabilitation investments. The major areas of information deficiency and outlines of the key issues that require greater research attention are highlighted in this chapter.

KEY FEATURES OF PAST RESEARCH INVESTIGATIONS ON IRRIGATION REHABILITATION

Declining Research Intensity in Recent Years

In Sri Lanka, research initiatives focused on irrigation rehabilitation projects emerged only in the 1970s and such efforts mainly coincided with studies conducted on the Tank Irrigation Modernization Project (TIMP). In the later years, the number of studies conducted on irrigation system rehabilitation showed a rapid growth and reached a peak in the mid-1980s. Since then, the volume of research investigations on irrigation rehabilitation projects has shown a distinct decline.

These changes in the intensity of research in the irrigation sector are largely determined by the amount of foreign funds channeled for rehabilitation works. The public sector organizations and the universities that are generally engaged in this type of research do not have adequate financial resources of their own for research work in irrigation sector development. The surge of research activity from the early 1980s to the mid-1980s is primarily a result of the heavy emphasis placed on research by the Gal Oya Water Management Project.

Discontinuity of Past Research Efforts

This literature survey suggests that, in the past, interest in conducting research investigations in irrigation rehabilitation activities has been sustained only for the duration of project implementation. When the project implementation period was over, the research programs were discontinued abruptly.

This tendency to abandon research activities is particularly notable in projects which have failed to achieve their initial goals. In such circumstances, follow-up research to unearth the reasons for failure is not conducted. Nevertheless, farmers are simply blamed for project failures because of their noncompliance with recommendations made by the project.

In general. the sharp withdrawal of research efforts at the end of project implementation is due to lack of financial provisions to sustain research activity. The discontinuation of research programs at the end of the project implementation period is a major deficiency in Sri Lanka's irrigation sector. This, in particular, creates difficulties for evaluating project influences on the beneficiaries and for understanding the long-term sustainability of project results.

Focus on Major Irrigation Schemes in the Dry Zone

Examination of the literature on irrigation rehabilitation projects suggests that the bulk of the research information currently available has been generated largely from studies on a few larger irrigation system in the dry zone. Research studies on the rehabilitation of minor irrigation schemes are relatively rare and the few that are available relate to those schemes located in the dry zone. Although minor irrigation works (anicut schemes) occupy a predominant position in rain-fed wet

zone agriculture, hardly any attempt has been made so far to conduct research studies on the rehabilitation of these schemes.

A major implication of this characteristic of the current research information base is that most of the existing knowledge on irrigation system improvement in Sri Lanka is built on a relatively narrow set of circumstances, i.e., large irrigation settlement schemes in the dry zone. Such information cannot be effectively applied to other types of schemes elsewhere. Hence, there is a strong need to broaden the research base in future study programs.

Qualitative Nature of the Information Base

A significant feature associated with the research methodologies adopted in much of the past work on irrigation rehabilitation in Sri Lanka is that, too often. the studies are designed to provide qualitative descriptions, with little or no emphasis on analytical aspects. Furthermore, in many investigations on rehabilitation of irrigation schemes, the analytical approach adopted does not reflect a multidisciplinary orientation, and this appears to be a major methodological deficiency.

Lack of Emphasis on Technical Research

An overall assessment of the available research material in the area of irrigation rehabilitation shows that almost all research studies conducted in the past are socioeconomic investigations. Studies on technical, engineering and hydrological field problems in the irrigation sector are virtually nonexistent in Sri Lanka.

Some initiatives to conduct technical research on irrigation and hydrology issues have been made in the past in some rehabilitation projects. As was seen in the earlier case studies, many attempts made to conduct such technical research have proven to be failures. In some instances, this failure appears to be mainly due to lack of relevance of the research program to the actual field problems. In some other instances, experiments are carefully designed and executed, but unfortunately, there has been no follow-up work to analyze the data.

The inadequacy or lack of emphasis placed on conducting technically oriented research — despite the existence of a strong Irrigation Department — is a major weakness in developing the irrigation sector of Sri Lanka.

Major Areas of Research Requiring Attention

The more important research areas that need attention are structured under the following nine broad themes:

1. Assessment of rehabilitation needs in the irrigation sector.
2. Project impact evaluation studies with emphasis on irrigation, agricultural, employment and income consequences.
3. Investigations on sustainability aspects of past and ongoing rehabilitation projects.
4. Studies on developing institutional capacities in irrigation systems with a view to learning from the past and introducing viable institutions.
5. Research programs leading to the generation of appropriate new technologies in agriculture and irrigation.
6. Investigations on costs and cost-effectiveness of rehabilitation and O&M operations.
7. Studies on irrigation cost recovery, and use and disbursement of funds.
8. Investigations on specific problems affecting irrigation system performance.
9. Transferability and communication of lessons learned.

Assessment of Rehabilitation Needs in the Irrigation Sector

Currently, there is a heavy demand for public funds at central as well as at provincial levels for rehabilitating irrigation systems. In recenl years, particularly after the estahlishnient of the provincial councils, the pressure for channeling funds for rehabilitation works in the provinces has increased mamyfold.

Given the limited financial and other resources available for rehabilitating the country's irrigation schemes, it is crucial to identify and prioritize the specific rehabilitation requirements of the country. Such information is currently not available either at the district level or at the provincial level.

Some of the research issues that require investigation are:

* Should a system in a particular location be given priority attention over another irrigation system in a different location?
* What would be the relevant criteria to determine priorities?
* At what stage should an irrigation system be rehabilitated?
* What level of investment is needed to rehabilitate a system?
* Can the O&M funds cover the usual system rehabilitation needs, particularly, if a "sustained renewal" approach is adopted?

A possible research approach that may be adopted in this regard would be to establish a set of criteria that would help lo identify and prioritize the rehabilitation needs of the imgation sector. Among the important issues that may be considered are theavailability of funds, cost intensity of rehabilitation, distribution benefits to be gained from rehabilitation, and farmers' willingness toprovide their own resources for rehabilitation.

Impact Assessment Studies with Emphasis on Irrigation, Agriculture, Employment and Income Consequences

So far, in Sri Lanka, no serious attempt has been made to identify the actual impact of irrigation rehabilitation projects. As mentioned above, the efforts to monitor project progress, analyze information anddocnmentproject activities and performance usually tend to cease with the completion of project works.

Impact assessment studies may be designed with respect to both completed projectsandongoingprojects. In both thesecases, the point of time at which the evaluation is undertaken is crucial in interpreting the study results and their implications.

In thecaseofongoing rehabilitation projects, an impact evaluationundertaken atan early stageofprojectimplementation would providecriticalinformationon the early developments of the project and would, thus, indicate the likely outcome of the project in the future. The assessment would help to diagnose project problems at an initial stage and, thereby, make appropriate "mid-course" corrections. The evaluation should be designed to provide early feedback regarding the project performance, before it is too late to take corrective action.

Impact evaluation studies on completed rehabilitation projects would also provide useful information in many otherrespects. In addition to indicating the natureofprogress made by the project, such astudy could identify thestrengths and weaknesses associated with therehabilitation strategy adoptedinthe project. The impact evaluation study would enable identification of the actual achievements of the project which could then be compared with the expectations. Any deviation between the planned achievements and actual achievementsneedsto be carefully studied with a view to ascertaining possible causes and to adopt necessaryremedial action. Such an assessment would not only bring outthemajor lessons thatshould belearnedfromtheprujectconcerned but would heusefulin designing future rehabilitation projects.

Impact evaluation studies need to focus on a number of major aspects of the project such as irrigation, agricultural production, employment and incomes. In most irrigation schemes in Sri Lanka, besides irrigation rehabilitation activities, many other development activities are also implemented concurrently. Thus, in identifying the impact of the rehabilitation project, it is essential to attempt to distinguish between the specific benefits arising purely from the rehabilitation

effort and benefits derived from other developmental efforts. A mistake often made in this regard is to attribute all incremental benefits in the irrigation scheme to the rehabilitation effort.

Agriculture is undoubtedly the single most important activity to be influenced by the rehabilitation efforts in any irrigation system. The level of agricultural output and its diversity are two of the more important determinants of settlers' income, employment and general farmer welfare. Thus, an analysis of the project impact on agricultural production is a critical indicator of the success or failure of the efforts made to rehabilitate the system.

Other indirect indicators that could also be used in measuring the final impact of the project are crop yields, level of application of improved cultivation methods, changes in profitability, levels of farm and off-farm employment creation, extent to which the production risks are lowered, and changes in cropping mix and cropping intensity. Often, projects are justified on the basis of increased farm production, employment and incomes. Hence, attempts should be made to examine the extent to which these expectations are achieved through the implementation of the project.

Project Sustainability: Implications for Policy and Operations

Almost all irrigation rehabilitation projects in Sri Lanka show a remarkably uniform consistency in demonstrating that the potential economic returns from investments in rehabilitation are high. Often, the predicted Economic Rate of Return (ERR) ranges between 20 percent and 40 percent. However, it appears that such high rates of return are not actually achieved in most irrigation rehabilitation projects. There is considerable evidence to show that the projects are usually performing below expectations. This situation, therefore, raises a fundamental issue of project sustainability, i.e., the ability of the system to maintain the expected level of benefit flows throughout the intended lifetime of the project.

Among the approaches that may be adopted to ascertain "sustainability," perhaps the simplest is to define and assess sustainability on the basis of economic rates of returns. If the reestimated ERR, after the project has been in operation for several years, is equal to or greater than the ERR at the time the project became operational, the project can he taken as sustained.

The other approach, which is more complicated, would involve the development of a composite index based on a set of indicators. The index should, in broad terms, be capable of assessing a number of important issues such as continuity of production benefits, maintenance of physical infrastructure, long-term institutional capacity, and strength and stability of support from the government and the community.

Studies on Strengthening Institutions

The role of local organizations as a vehicle for mobilizing farmer involvement in irrigation rehabilitation, operation and maintenance is now accepted. In fact, all new projects have incorporated this aspect in the implemental programs.

However, the specific means of achieving beneficiary participation is little understood and much needs to be done to progress further. The key problems to be addressed in this regard are the initiation, continuation, viability and replicability of these organizations. It appears that, often, the methods used to initiate farmers' organizations are ad hoc and are not based on systematic approaches.

Research Studies on Introduction and Adaptation of Technology

During the 1980s, the food-crop sector in Sri Lanka showed a situation characterized by rising production costs with no commensurate increases in output prices. During this period, per-hectare crop yields also remained virtually stagnant. Under these circumstances, it is now becoming increasingly important to introduce new crop-production technologies that would reduce production costs and increase productivity. Similarly, from the point of view of irrigation too, there is an emerging need to introduce new technologies to meet the emerging challenges.

Unless significant changes in production technologies are introduced, it would he difficult to maintain the economic viability of most of the irrigation rehabilitation projects.

Studies on Cost-Effectiveness of Irrigation Rehabilitation Projects

As already discussed in the previous chapter, achieving cost-effectiveness in irrigation system rehabilitation as well as in O&M operations is a critical issue receiving considerable attention. Since hardly any research has baen undertaken in this regard, it is necessary to direct research attention to the examination of the relevant issues.

In the past, rehabilitation of irrigation systems was undertaken through a variety of strategies. Each of these strategies was associated with different levels of cost intensities and efficiencies which could be ascertained and evaluated.

Studies on cost-effective O&M strategies form another critical area of research that requires attention. Recently, some useful work in this regard has been conducted through the intervention of ISMP. This work is focused on the cost of maintenance of selected irrigation systems, mainly to establish technically adequate maintenance and to identify institutional arrangements that would ensure cost-effective maintenance (TEAMS 1991). The study indicates a number of avenues for improvement and the analysis could be used as a basis for developing and designing further research

Approaches for Recouping Investments in Irrigation Rehabilitation

Throughout the recent past, there has been a growing concern of the government to recoup at least a part of the funds diverted for imgation rehabilitation. In relation to this issue, some research work has already been done but this information needs updating and more in-depth investigation. Some of the issues that need investigation involve the determination of actual costs required for rehabilitation and O&M, the setting up of O&M standards for different situations, investigation of the ability of the farmers to pay, administrative organizations appropriate for fee collection, and mechanisms to be adopted for fee collection, modes of fee collection as well as the costs of fee collection.

Studies Providing Insights into the Problems in Older Irrigation Settlement Schemes

This category of research needs to be designed to understand the overall nature of the problems faced by irrigation settlement schemes. Some of the common problems that appear to be affecting the performance of the irrigation settlements are: second-generation and attendant economic, sociological and other problems, land tenure and fragmentation, technological stagnation and the consequent leveling off of productivity, nonavailability of nonfarm employment, problems of access to cash and related credit problems, etc. A detailed examination of these issue would help to understand the irrigation system operation better. This, in turn, would help planning and implementation of rehabilitation projects more effectively.

Transferability and Communication of Lessons Learned

This literature survey has shown that there are many lessons that could be usefully transferred, directly or indirectly, with appropriate changes to other irrigation rehabilitation projects.

The process of transferring information would involve a series of communication activities between various interested groups. This process involves many research questions such as: What mechanisms can he developed to improve communication among and within agencies, donors. and other interested parties to spread the rehabilitation lessons learned in different projects? and What steps can be taken to ensure that some of the mistakes done in the past will not he repeated in projects implemented in the future?

In most rehabilitation activities, the interactions among the various categories of interested parties constitute an area which is not much researched and it deserves greater attention in order to understand better, why rehabilitation projects are designed the way they are and to suggest alternative approaches. The study undertaken by IIMI at Uda Walawe is one of the few that throws some light in these directions.

There is also a need for providing information in local languages for the farmers and others involved in irrigation. Currently, all the literature available on

irrigation is published in the English medium, and translation of the more important material would be helpful.

In conclusion, it is necessary to highlight that collecting research information is a costly and time-consuming task. Therefore, in designing research studies, it is important to prioritize the problems to be studied. In disseminating research results among farmers, it is necessary to ensure that the recommendations are relevant and acceptable to the farmers economically as well as socially, in the long run.

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