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International Conference on Irrigation System Rehabilitation and Betterment

Volume 1: Proceedings



Water Management Synthesis II Project

**International Conference on
Irrigation System Rehabilitation and Betterment
Volume 1: Proceedings**

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WATER MANAGEMENT SYNTHESIS II PROJECT

University Services Center
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Consortium for International Development

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Mohammed I. Haider
Conference Coordinator

EXECUTIVE SUMMARY

An international conference on irrigation system rehabilitation and betterment was held in Leesburg, Virginia, October 27-31, 1986. The conference was sponsored by the United States Agency for International Development (USAID) and was organized by the Water Management Synthesis Project. The objectives of the conference were to bring together representatives of donor and lending organizations, country policy makers, project implementors, and researchers to jointly review and discuss the lessons learned from rehabilitation and betterment efforts, to identify problems encountered, and to develop guidelines for better planning, implementing, and monitoring rehabilitation projects.

Participants included officials from 20 countries, as well as representatives from USAID, Asian Development Bank, the World Bank, Ford Foundation, the Food and Agriculture Organization of the United Nations (FAO), the International Irrigation Management Institute (IIMI), the International Food Policy Research Institute (IFPRI), Overseas Development Institute, and several consulting firms.

The topics discussed at the conference were:

1. factors contributing to system deterioration and the need for rehabilitation and betterment.
2. objectives and scope of rehabilitation and betterment.
3. appropriate timing and criteria for the success of a rehabilitation and betterment project.
4. policies and institutional arrangements.
5. planning and implementation.
6. monitoring and evaluation of rehabilitation and betterment projects.

Rehabilitation and betterment were characterized as a joint process that combines the elements of deferred maintenance and the notion of change for upgrading system performance in light of current needs and opportunities. Underlying economic, social and political factors for inadequate system maintenance were highlighted, as well as the need for upgrading structures and operational procedures over time.

The common problems with rehabilitation and betterment projects identified by the conference participants can be classified into:

- inadequate focus on system operation and management.
- inflexible design and a rigid implementation schedule.
- use of an inadequate data base and out-of-date information for project planning.

- poor coordination among the agencies involved.
- inadequate farmer involvement.
- lack of an effective monitoring and evaluation program.
- inadequate consideration of the sustainability of improvements made.

The following guidelines and recommendations were proposed to obtain more effective rehabilitation and betterment projects:

1. Due to the dynamic nature of the irrigation system and its environment, the irrigation system generally should not be restored to its original design specifications.
2. Rehabilitation and betterment should be viewed and planned as a joint process.
3. The current construction orientation of most agencies should be replaced by a balanced approach that improves management as well as structures.
4. Rehabilitation and betterment projects should be flexible, allowing adjustments during project implementation to correct errors in planning and to respond to new information.
5. The institutional capacity for actively involving farmers should be developed.
6. Farmer involvement should be encouraged from the design stage, and farmers should be given some decision-making authority.
7. Greater emphasis should be placed on project design. Planning for design should involve consultation with relevant national, regional and local officials, and with operation and maintenance personnel and farmers.
8. In large projects, one to two years should be set aside for project start-up, and project implementation should be longer than the typical five-year period.
9. Diagnostic analysis of the irrigation system should be part of the planning process.
10. Realistic goals and objectives for the rehabilitation project should be set. Overly optimistic goals to meet broad economic and other criteria should be avoided.
11. Donor and lending organizations should further pursue combining grants and loans in rehabilitation and betterment projects to fund technical assistance.
12. Greater emphasis should be given to the economics of rehabilitation and betterment to determine when to undertake a rehabilitation

tation and betterment project, the amount of investment in the project, and the improvements that have high benefits. The economics of cost recovery for system operation and maintenance, as well as capital investments, need to be further examined.

13. The agency selected to function as lead organization for a rehabilitation and betterment project must expand its functional and multidisciplinary capability.
14. Roles, responsibilities, sharing of funds, and training opportunities should be clearly defined for all participating agencies before a project begins. The role that each agency plays should be complemented by specific incentives.
15. New policies (i.e., irrigation service fees) should be formulated and communicated to water users and others involved in the process prior to project implementation and not during and after.
16. Farmers should be involved in collecting and using irrigation fees to improve the collection and use of these fees.
17. The monitoring and evaluation unit should be linked with the project management office to effectively and judiciously make revisions during project implementation.
18. A coordinating and feedback mechanism should be developed among and within agencies for continuous learning from the rehabilitation and betterment effort. The feedback process should allow for communication with policy-making officials.

The above guidelines and recommendations for improving rehabilitation and betterment efforts represent current understanding. With the growing experience in this area, these guidelines for rehabilitation and betterment should be further developed and refined.

PROCEEDINGS

About The Conference

In light of growing interest and investment in irrigation system rehabilitation and betterment and the need for improving the process and outcome of rehabilitation projects, the International Conference on Irrigation System Rehabilitation and Betterment was organized. The conference was held October 27-31, 1986, in Leesburg, Virginia, and was sponsored by the United States Agency for International Development through the Water Management Synthesis II Project. The objectives of this conference were to synthesize the knowledge acquired from previous rehabilitation projects, provide an opportunity for sharing views on irrigation system rehabilitation, identify problems, and develop guidelines for better planning, implementing, and monitoring rehabilitation projects.

The conference program included simulated field trips,¹ working group discussions, panel presentations, and presentations of papers and case studies. Participants from 20 countries attended the conference. They included policy makers, project implementors, and researchers from developing countries. International development, donor, and lending organizations were represented by the United States Agency for International Development, Asian Development Bank, World Bank, the Food and Agriculture Organization of the United Nations, and the Ford Foundation. The International Irrigation Management Institute, the Consortium for International Development, and several consulting firms played an active role in this conference. See Appendices A and B for the conference program and list of participants.

A summary of the major areas of discussion, points of consensus, unresolved issues, and a number of proposed guidelines for irrigation system rehabilitation are presented in this report. The papers and case studies that were presented and distributed at the conference are compiled in a separate volume.²

An Overview

The potential for increasing food production by increasing irrigated area has led to massive investment in irrigation infrastructure over the past 35 years. The recognition that irrigated land produces more food, reduces the risk of crop loss from drought, and promotes the use of new agricultural technology (primarily purchased inputs) encouraged investment in new irrigation systems. Expansion in irrigated area has indeed led to a major increase in food production and has even generated surpluses in some countries. Food production in India, for example, has tripled over the past 30 years, and fam-

ines that once characterized drought years no longer plague the country. A number of Asian countries, including the Philippines and Indonesia, have tripled their rice production over the past 15 years. Today, Indonesia, the Philippines, Nepal, and Sri Lanka are considered to have reached the threshold of self sufficiency in rice production.

Since the late 1970s, there has been a shift in emphasis toward improving existing irrigation systems instead of establishing new facilities. As noted in the conference, conditions which have led to the redirection of interest and resources to the rehabilitation and betterment (R&B) of existing systems include:

- growing scarcity of suitable land and irrigation water. To varying degrees, it has become difficult and costly to undertake new irrigation projects.
- rapid deterioration of existing irrigation systems and low irrigation efficiency.
- growing recognition of the problems being faced in older systems and the potential for increasing production in these systems.
- the need for continued increase in food production to meet the growing demand from population growth and rising income.
- pressure from farmers to improve the delivery and distribution of irrigation water.
- the preference of donor and lending organizations, based on the accepted idea that rehabilitation projects increase production at considerably lower capital cost than the construction of new irrigation systems.

The desirability of enhancing the performance of existing irrigation systems was generally agreed upon at the conference. However, there was considerable debate on the degree of success in R&B projects and on the approaches to better planning and implementing them.

Most R&B projects have experienced the problems encountered in new irrigation projects and have also posed new constraints and challenges to project designers and implementors. Time and cost overruns are common. Rehabilitation projects have perpetuated inappropriate engineering design, and have heavily focused on structural improvement with little or no consideration of the system's operation and management. Projects have been designed based on highly inadequate information on the existing conditions and performance of the system. Monitoring and evaluation programs have been planned as an afterthought and done as a sideline activity. Input from the farmers in the planning and implementation of projects has been minimal to nonexistent. Overall, rehabilitation projects have been unable to achieve their expected outcome. In

some cases, the irrigation system is in need of rehabilitation before the project is completed.

Rehabilitation and Betterment: Toward A Consensus

What are Rehabilitation and Betterment?

Rehabilitation was interpreted as a process to deal with the problems emerging from inadequate system maintenance; betterment was seen as a means of upgrading system performance given current needs and opportunities. As such, these two components should be viewed as a joint process and not exclusive of each other.

There was a general awareness among conference participants that irrigation systems are dynamic. Changes also occur in the environment in which an irrigation system operates. Hence, appropriate measures for improving the performance of an irrigation system will result in modified structural arrangements and operational procedures.

Rehabilitation and Betterment often involve building structures and other modifications, but R&B certainly go beyond that. Rehabilitation and betterment involve change in institutions and the management of systems. Rehabilitation and betterment of irrigation systems have been planned as part of integrated agricultural development programs. While this approach has been appealing conceptually, it has encountered difficulty in implementation due to coordination problems among line agencies or due to the inability to create an effective "super agency" to plan and implement the project.

In terms of objectives, some conference participants proposed that an R&B project should seek the causative factors behind poor system conditions and performance. While this was considered generally appropriate, it was noted that a process that would identify a manageable set of objectives was needed.

A broad set of objectives was listed for R&B projects by the participants. These include:

- improving equity in water distribution.
- saving irrigation water by improving irrigation efficiency.
- upgrading the level of technology for improved system management.
- facilitating the operation and management of the system.
- increasing cropping intensity.
- expanding the irrigated command area.
- increasing productivity.
- directing the cost of operation and management to the farmers.
- meeting the social and political goals of the country.

It was also noted by some participants that, unfortunately, aesthetics and the installation of high technology facilities for their own sake have become

an objective in themselves — more than we would like to admit.

How the Need for Rehabilitation and Betterment Arises

It is critical to understand the underlying factors leading to system deterioration in order to devise solutions. In this regard, it was pointed out by Dr. Gilbert Levine of Cornell University that little information exists on how an irrigation system deteriorates (i.e., general decline in hydraulic performance) and what the implications are.

From the discussions concerning this issue, the conclusion is that deterioration due to normal wear and tear does not alone explain the rapid deterioration of irrigation systems. Many economic, social, and political factors underlie inadequate system maintenance and rapid system deterioration which need to be understood and dealt with.

With respect to the rationale for the lack of maintenance, Dr. Levine argued that:

"... the immediate costs associated with regular routine maintenance — financial, organizational and political — may not be balanced by the benefits from such maintenance, if one discounts the benefits for the time lag between incurring the maintenance costs and obtaining the benefits."³

Excess capacity in the original system design, the ability of farmers to manage irrigation more carefully under stress within certain limits, and the proportionately slow decline in yield in response to the decline in water supply at the high end of the water availability scale significantly delay the impact of deferred maintenance on production and farm income. These physical effects, in conjunction with the high discounting of the stream of benefits over time in developing countries, indicate why irrigation systems are allowed to deteriorate. These propositions generated considerable interest at the conference and need to be further explored.

There was general agreement at the conference that the maintenance funds provided for most irrigation systems in developing countries have not been adequate. Maintenance funds usually come from the regular appropriation budget, for which there are always competing and higher priority uses. The fund for a rehabilitation program comes from the development budget, which is regularly supplemented by donors. This funding procedure encourages the practice of allowing irrigation systems to deteriorate to the point where rehabilitation becomes necessary.

Eventually, the impact of deferred maintenance on productivity and farm income leads farmers to exert pressure through the political system for corrective action. The need to deal with the prob-

lems emerging from deferred maintenance, combined with the potential for upgrading system performance, leads to proposals for the rehabilitation and betterment of the system.

The conference participants suggested that the following factors lead to the need to rehabilitate and upgrade irrigation systems:

- changes in field conditions and irrigated areas made by the farmers.
- mistakes in the original design.
- inappropriate farmer participation.
- inadequate funds for maintenance.
- poor operation of the system by the irrigation authority.
- the need to improve the canal system to better cater to the existing situation.
- the need to improve the institutional arrangements for better management of the system.
- the need to improve the operational aspects of the canal system for better management of the distribution system and to improve the equity of distribution.

Recognizing that it would be difficult to completely eliminate the need for rehabilitation, it was recommended that a process for continuing maintenance and improvement be designed and implemented that would reduce the frequency of rehabilitation.

In this regard, Dr. Worth Fitzgerald of the Bureau of Science and Technology, USAID, stated that the U.S. General Accounting Office recommends placing greater emphasis on operation and maintenance programs in developing countries. Currently, donors and lending organizations are considering the possibility of providing funds to meet the recurrent costs of system operation and maintenance.

When are Rehabilitation and Betterment Appropriate?

At the conference the participants were posed with the question: *At what level of deterioration or, alternately, at what level of performance should an irrigation system be selected for rehabilitation and betterment?*

The criteria commonly suggested stress the problems of physical deterioration that exist in the irrigation system. The effect of these problems are commonly identified as inequity in water distribution, poor irrigation efficiency, low productivity, and low farm income. Other criteria for the appropriateness of R&B discussed at the conference included the following:

- Rehabilitation is appropriate when initial objectives have become obsolete due to changes in system conditions and needs.
- Rehabilitation is appropriate when required by external conditions; i.e., food shortage.
- Rehabilitation is appropriate when a system reaches a level of deterioration where regular

maintenance cannot result in appreciable change in irrigation efficiency.

- Irrigation systems should be rehabilitated "before it is too late."
- Rehabilitation is appropriate when clients are willing to accept the change.

The decision to rehabilitate should be reached by a consensus of the parties involved — implementing and enabling agencies, farmers, and donor and lending organizations; and not just by those least directly affected by the change.

At the conference, attention was directed to the tendency of the participants to view the need and appropriateness of R&B from the perspective of physical improvements and policies, and that the economics of R&B had received very little attention. It was urged that the economics of rehabilitation should be seriously examined in planning R&B projects.

When are Rehabilitation and Betterment Successful?

Conference participants were asked when an R&B project would be considered successful. Their responses were categorized as follows: (1) if the project meets the stated project objectives, (2) if the project generates desired changes or improvements, (3) if the project solves underlying problems, and (4) if the project achieves the procedural and institutional changes considered essential to improving system performance.

The idea of attaining project objectives led to considerable discussion on the appropriateness and accuracy of the procedures used to select objectives and in determining the level of increase in system performance.

Many projects are designed and projections in the level of improvement are made based on inadequate data. Projections are not realistic. The tendency has been to determine the performance levels to be achieved based on approaches suggested in texts, which are seldom achievable in actual field conditions. Proposal writing teams may also overestimate the potential outcome and benefits from R&B. These practices in themselves can lead to evaluation results that show shortfalls in project performance in relation to the objectives set.

Desirable improvements in rehabilitation projects, as proposed by some participants, include achieving new design efficiencies throughout the system, gaining appreciable increases in equity of water distribution, meeting the need for changed cropping patterns and improved practices, and perceptibly increasing farm income. Others imposed much more stringent conditions on success, indicating that the factors felt to cause "overly-rapid" system deterioration (such as watershed deforestation) must be removed.

Farmer involvement in planning, implementing, and monitoring rehabilitation projects and in system operation and maintenance was considered essential. The establishment of good communication between farmers and the irrigation agency was also suggested as a measure of success. Establishing a continuous improvement process, as well as an institutionalized, adequate, maintenance program, was suggested as a conditional outcome before a rehabilitation project is called successful.

Policy Issues and Institutional Arrangements

Policies and Perceptions Toward Rehabilitation and Betterment

The participants from the donor and lending organizations noted that their organizations look favorably on irrigation system rehabilitation. It is generally accepted that it is costlier to build new irrigation systems and, therefore, economically less attractive than to rehabilitate existing irrigation systems — particularly in the face of falling commodity prices. For this reason, it is considered appropriate to continue funding R&B projects while also developing new irrigation systems where feasible.

The developing countries' participants indicated the positive role that the donor and the lending organizations have played in the rehabilitation and betterment of irrigation systems. However, they added that R&B projects have been planned and funded faster than some countries can undertake. These countries have been unable to effectively plan and carry out rehabilitation projects under the current rapid schedule.

Many loans and grants for rehabilitation and betterment have been made, and this trend is likely to continue in the foreseeable future. However, it was learned from the donor and lending organizations' group at the conference that they do not have separate policies and procedures for dealing with an R&B project as they do for developing a new irrigation system.

The donor and lending organizations' group emphasized the need to increase technical assistance for R&B projects. The current level of funding for technical assistance is inadequate to meet the cost of starting and completing the necessary studies and of training staff for the projects. Developing countries' governments have been reluctant to use loan funds for technical assistance. Grants are an important means of financing technical assistance, but not all donor and lending organizations have the ability to provide adequate grants. Some agencies are better equipped to provide grants than others. Co-financing an R&B project as a means of providing funds for technical assistance programs was recommended.

Recovery of Operation, Maintenance, and Capital Costs

There was general agreement between the donor and lending organizations and the country policy groups that the beneficiary should pay the full cost of system operation and maintenance. However, opinions varied on whether or not the beneficiaries should contribute toward the recovery of capital costs.

In this regard, the irrigation policy and planning groups concluded that the government should pay the cost of building the infrastructure and the farmers should pay the cost of operating and maintaining the irrigation system. These groups further added that it has been extremely difficult to collect irrigation fees from the farmers and made the following recommendations for improving the collection of irrigation fees:

- Develop water users' associations. Water users' associations are more effective in collecting funds than individual assessment.
- Give decision-making authority to farmers. It was suggested that irrigation administrations should be reorganized to allow for users' consultation, input and decision-making.
- Encourage farmer involvement from the design stage. Postponing farmer involvement until a project is completed reduces the likelihood of recovering costs from the farmers.
- Provide reliable delivery and equitable distribution of irrigation water among farmers.
- Involve farmers in the collection and use of irrigation fees. Farmers are reluctant to pay if fees collected for system operation and maintenance are not used in their irrigation system in conformity with what the farmers perceive as necessary improvements. The farmers do not like to pay irrigation fees when they feel the irrigation agency's staff is negligent.
- Give farmers free market prices for their commodities if they are required to pay irrigation fees. Farmers need to generate sufficient income from their operation to pay irrigation fees.

Project Coordination

Choosing the lead institution for R&B is critical and difficult. The alternative choices for a lead agency have been a "line agency", such as an irrigation department, and a "super agency", such as a new authority. The conference participants debated the advantages and the disadvantages of each alternative, but did not unanimously prefer one institutional arrangement over the other.⁴

Planning and implementing R&B projects through a line agency has been difficult in the past

due to the narrow view the different agencies have about the irrigation system. An irrigation department sees the system as a water delivery system, while the agricultural department sees it as use of non-water inputs and extension. Distributing funds between the various line agencies and getting individuals from various disciplines to work together has not been easy.

It was recommended that when a line agency is selected to function as a lead organization for an R&B project, it must first expand its functional and multi-disciplinary capability. Line agencies should start coordinating with one another by defining their objectives and agenda in light of the overall project goals. There is a need to clearly delineate roles, responsibilities, sharing of funds, and training opportunities before a project begins.

The role of each agency should be clearly defined, and incentives should be developed to insure that each agency will carry out its role. The role must be complemented by incentive for the agency.

As an alternative to a line agency, a new authority could be created. A "super agency" or a new authority reduces the power of the line agencies and, as such, can be a source of conflict. In the long run, authorities have behaved like line agencies and have raised the problem of coordinating the actions of authorities and line agencies.

It was observed that regardless of whether or not the project is guided by a line agency or a super agency, the channels and mechanisms that make the agencies accountable to their client or beneficiary group should be developed in ways appropriate to the situation. Further, a coordination and feedback mechanism should be developed among and within agencies so that there is continuous learning from R&B efforts. The feedback process should allow for communicating this knowledge to policy-level officials.

Changes in system operation and management need to be seriously considered along with structural improvements as a means of improving system performance. The current construction orientation of most agencies should be replaced by a balanced approach toward improving structures and management and toward becoming more willing and able to work with water users.

Planning and Implementing a Rehabilitation and Betterment Project

As an important step, improvements in the planning and design process that would reduce R&B effort and cost were suggested.

Flexibility was proposed as the common theme for improving approaches to planning and implementing an R&B project. Planning and implementation should be looked upon as a continually evolving

and generative process. The project should be capable of short-term adjustments by recognizing circumstances which were not assumed in the project paper or in response to new knowledge or information.

It is difficult to plan for flexibility in a short-term project. Further, it is difficult to reconcile the requirements of an evolving project with the constraints of the financing agencies that like tightly budgeted projects. It was proposed that some time should be set aside for project start-up (one to two years), and the implementation period should be longer than the typical five-year period.

Greater emphasis should be placed on project design. Planning should involve consultations with relevant national, regional and local officials and with operation and maintenance personnel and farmers. Planning should also involve a diagnostic analysis⁵ of the irrigation system. This is needed to achieve better understanding of the constraints associated with the irrigation system, to devise appropriate improvements, and to develop the institutional capacity for implementing the project with effective farmer participation. Project designers must understand the system's current condition and performance level in order to plan improvements.

The need to conduct a diagnostic analysis of the irrigation system prior to R&B was generally recognized by the participants. The constraints identified by a diagnostic analysis should be evaluated in view of the potential for improvement. The objectives and goals for the project should then be formulated. Further, it was recommended that goals should be realistic and achievable. The pitfalls of having overly optimistic goals to meet broad economic and other criteria should be avoided.

During planning, sufficient time should be allowed for local consultations and to assess support from the farmers. Pre-rehabilitation studies and determining project objectives should be done with the active participation of farmers and local agencies. The institutional objectives are not necessarily the same as the objectives of farmers.

Institutional capacity should be expanded before implementation is undertaken. Farmers' participation is often assumed, and there is usually no institutional capacity for involving them.

Farmer participation in construction activities, system operation and maintenance, and monitoring and evaluation should be arranged in the planning stage. Similarly, all new policies, (i.e., irrigation service fees) should be formulated and communicated to water users and others involved in the process prior to rehabilitation, not during or after rehabilitation is complete.

Three approaches to planning and implementing R&B were suggested by the participants. The

first approach suggested starting R&B in system operation and management, followed by structural improvement. It was suggested by some that structural improvements be made conditional to successfully completing improvements in system operation and management. As a rationale for this approach, it was noted that (1) most R&B projects have primarily focused on structural improvements and have ignored the potential benefits of improving system operation and management, and (2) non-physical improvements are more difficult to make and therefore should commence earlier in the time frame.

The second approach suggested starting the R&B process at the on-farm level and moving to the main system. It was observed that this approach would provide a better sense of how the system operates and what improvements need to be made in the main system in relation to the on-farm system for an overall increase in performance. Farmers can become more actively involved in the R&B process, and the focus of the irrigation agencies would be better directed toward achieving the objective of increased productivity and farmer income.

The third approach is based on a flexible R&B strategy. It was recommended that a diagnostic analysis be done throughout the project period. The constraints identified by this process should be ranked in the order of priority and the corresponding plans for improvements made.

As a general implementation strategy, it was suggested that the operation and maintenance personnel be involved in an R&B effort. This should help ensure that the required improvements are made, making the need for rehabilitation less frequent. The interdisciplinary interaction created during planning should be maintained throughout implementation. Farmers should be consulted regularly.

Monitoring and Evaluating a Rehabilitation and Betterment Project

The case studies presented at the conference and the information conveyed by the researchers and project implementors indicates that the monitoring and evaluation components of most R&B projects are poorly planned and implemented. Monitoring and evaluation are carried out mostly as a sideline activity, and there is little or no ability to revise the on-going project's method of implementing the rehabilitation and betterment. In addition to the above, the data gathered for monitoring and evaluation were not analyzed or were inadequate for determining the degree of project success.

In light of experience with monitoring and evaluation programs, it was strongly recommended at the conference that monitoring and evaluation programs be designed, that the responsible institu-

tion for carrying it out be selected, and that the staff be trained during the planning stage. Monitoring and evaluation should be an integral part of R&B and used as a mechanism for making changes in the on-going project.

The need for fully integrating monitoring and evaluation into project operation was expressed by one participant as "monitoring and evaluation are too important to be left to the information specialist." It was recommended that the monitoring and evaluation unit be linked with the project management office to effectively and judiciously correct the course of project implementation. This link to decision and action is needed if monitoring and evaluation are to be relevant and sustained.

One cannot assume that monitoring and evaluation objectives and criteria are the same for all the users of a monitoring and evaluation program (i.e., project implementors, policy makers, and donor and lending organizations). A monitoring and evaluation program should meet the need of various "clients." In planning a monitoring and evaluation program, we should also be cognizant of the implicit or unstated objectives of the project.

Concluding Remarks

This conference brought together 81 participants from 20 countries, bilateral and multilateral development organizations, international research organizations, consulting firms, and universities that are involved in irrigation system rehabilitation and betterment. The conference structure accommodated sharing of knowledge and experiences, identification of problem areas, and development of guidelines for rehabilitation and betterment. The active role played by the participants at the conference made this progress possible.

The discussion panel on "Conference Learning About Rehabilitation and Betterment" highlighted the value of the conference findings and recommendations in various countries. There was also the realization of how "amorphous" rehabilitation and betterment are and that there is a need to further our understanding in this area. Along these lines, follow-up programs are needed to expand and refine the guidelines for R&B and their use in planning and implementing rehabilitation and betterment projects.

Notes

1. Two simulated field trips, one on the Niazbeg Irrigation System, Pakistan, and one on the Sirsia Irrigation System, Nepal, were videotaped and presented at the conference. These videotapes were designed to show two different irrigation systems in need of rehabilitation and betterment and to obtain the participants' input on how to

design an R&B project incorporating information gained at the conference.

The videotapes and corresponding scripts for the simulated field trips are not included in the conference proceedings. However, they can be obtained from the Water Management Synthesis II Project, Colorado State University, Fort Collins, CO.

2. Fowler, D. (ed.) 1987. *International Conference on Irrigation System Rehabilitation and Betterment, Volume 2: Papers*. Water Management Synthesis II Project, Colorado State University, Fort Collins, CO.
3. For further details, see Dr. Levine's paper titled "The Challenge of Rehabilitation and Betterment" in Fowler, D. (ed.), 1987, *International Conference on Irrigation System Rehabilitation and Betterment, Volume 2: Papers*, Water Management Synthesis II Project, Colorado State University, Fort Collins, CO.
4. For ideas on inter-organizational coordination and management planning for a rehabilitation and betterment project, see "Irrigation System Rehabilitation: The Need for Pre-Rehabilitation Studies" prepared by Dr. Wayne Clyma and Dr. Dan Lattimore in Fowler, D. (ed.), 1987, *International Conference on Irrigation System Rehabilitation and Betterment, Volume 2: Papers*, Water Management Synthesis II Project, Colorado State University, Fort Collins, CO.
5. For information on the diagnostic analysis concept and methodology, see "Irrigation System Rehabilitation: The Need for Pre-Rehabilitation Studies" prepared by Dr. Wayne Clyma and Dr. Dan Lattimore in Fowler, D. (ed.), 1987, *International Conference on Irrigation System Rehabilitation and Betterment, Volume 2: Papers*, Water Management Synthesis II Project, Colorado State University, Fort Collins, CO.

Also see Lowdermilk *et al.*, 1983, *Diagnostic Analysis of Irrigation Systems, Volume I: Concepts and Methodology*, Water Management Synthesis II Project, Colorado State University, Fort Collins, CO.

APPENDIX A:
**International Conference on Irrigation System
 Rehabilitation and Betterment**

PROGRAM

Monday, October 27

9:00 am	Welcome and Introduction	Duane Acker
9:10 am	Conference Objectives and Structure	Mohammed Haider
9:20 am	Keynote Presentation: The Challenge of Rehabilitation and Betterment	Gilbert Levine
10:30 am	Working Group Discussion: Rehabilitation and Betterment: What is it? When is it Appropriate? When is it Successful?	
1:00 pm	Working Group Discussion: Planning for panel presentation on Perspectives on Rehabilitation and Betterment	
3:00 pm	Summary of Working Groups' Conclusions: Criteria for Evaluating Irrigation System Rehabilitation	Mark Svendsen
3:10 pm	Panel Presentation: Perspectives on Rehabilitation and Betterment	Moderator: Gaylord Skogerboe
	<ul style="list-style-type: none"> • Country Policy • Donor and International Development Agencies • Project Implementors • Researchers, Planners, and Performance Evaluators • Users 	
7:30 pm	Conference Dinner	Speaker: Richard McComen

Tuesday, October 28

9:00 am	Introduction	
9:05 am	Some Concepts to Consider in an Irrigation System Rehabilitation Project	Wayne Clyma
9:20 am	Case Study 1: The Tank Irrigation Modernization Project of Sri Lanka. Provided by the International Irrigation Management Institute.	Hammond Murray-Rust
10:15 am	Case Study 2: Irrigation System Improvement and Farmer Participation, Nong Wai, Thailand. Provided by Asian Development Bank.	Satish Jha
11:15 am	Case Study 3: Periyar-Vaigai Rehabilitation Project, India. Provided by USAID/Water Management Synthesis II Project.	R. Sakhivadivel
2:00 pm	Case Study 4: West Tarum Canal Improvement, Indonesia. Provided by World Bank.	Roy Hewson
3:30 pm	Case Study 5: Gal Oya Rehabilitation Project, Sri Lanka. Provided by USAID/Water Management Synthesis II Project.	G.M. Wijayaratna
4:30 pm	Introduction to Wednesday's program	
7:30 pm	The Main Socio-Economic and Institutional Differences Between Asia and Sub-Saharan Africa in Regard to Rehabilitation Programmes. Provided by Overseas Development Institute.	Mary Tiffen
	Approach to Irrigation System Rehabilitation and Betterment: A U.S. Perspective. Provided by CH2M Hill Consultants.	Robert Charley

Wednesday, October 29

8:30 am	Working Group Discussions: Implications of Experience in Irrigation System Rehabilitation and Betterment for Improving Guidelines and Practices in:	
	(A) Sector Policies and Planning (i.e., collaboration among agencies, irrigation service fees, financing system operation and maintenance, project staffing)	
	(B) Project Planning and Implementation (i.e., pre-rehabilitation studies, staff training, farmer involvement, system operation and maintenance after rehabilitation, design changes, improvements in system management)	
	(C) System Performance and Evaluation (i.e., the need and value of monitoring and evaluating rehabilitation projects, problems associated with monitoring program, strategy for designing a monitoring program)	
	Plenary: Reports of working group conclusions	
7:30 pm	Computer Simulation Exercise for Irrigation System Rehabilitation. Provided by USAID/Water Management Synthesis II Project.	Norman Uphoff Tammo Steenhuis Tom Sheng
	Irrigation System Rehabilitation: The Need for Pre-Rehabilitation Studies. Provided by USAID/Water Management Synthesis II Project.	Wayne Clyma
8:15 pm	Measuring Irrigation Performance in Rehabilitation Projects.	Charles Abernethy

Thursday, October 30

- 8:30 am Introduction
- 8:35 am **Summary of Conclusions on Guidelines and Practices** Norman Uphoff
- 8:50 am **Introduction to Simulated Field Trips** W. Robert Laitos
- 9:00 am Problem-Solving Exercise: **Simulated Field Trips to Irrigation Systems Apparently in Need of Rehabilitation and Betterment:**
- **Sirsia, Nepal**
 - **Niazbeg, Pakistan**
- 10:30 am Sub-Groups: Additional information on the Niazbeg and Sirsia irrigation systems
- 11:00 am Working Group Discussion: Interdisciplinary Decision-Making About Whether or Not to Rehabilitate and if so, What Kind of Rehabilitation is Appropriate for the System
- 2:00 pm Working Groups: Prepare project memorandum on the irrigation system(s) in need of rehabilitation
- 4:30 pm **Improving the Operation of Surface Irrigation Systems.** Provided by World Bank. H.L. Plusquellec

Friday, October 31

- 8:30 am Plenary: Reports of group recommendations for rehabilitating the Sirsia and Niazbeg irrigation systems
- 11:00 am Panel Discussion: **Conference Learning about Rehabilitation and Betterment** Moderator:
Mark Svendsen
- 12:20 pm **Concluding Remarks on the Conference** Mohammed Haider

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