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Assistance to Farmer-Managed Irrigation Systems

farmer managed irrigation systems
farmer participation | project appraisal
rehabilitation

Assistance to Farmer-Managed Irrigation Systems

Results, Lessons, and Recommendations from an Action-Research Project

by

Water and Energy Commission Secretariat, Nepal
and
International Irrigation Management Institute

INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

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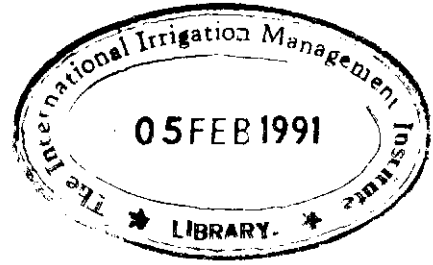

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Foreword

SMALL FARMER-MANAGED IRRIGATION systems are an important element in the programs of irrigation management studies of the International Irrigation Management Institute (IIMI). Systems built and managed by farmers in diverse environments exhibit a wide range of management capacities. Some perform very well; others struggle to survive.

Awareness of these systems, and of their numbers and diversity, as well as their economic and social contributions, has been growing in many countries. With that awareness have come programs of assistance, by government agencies, intended to make these systems more productive and sustainable. IIMI is interested in the effectiveness of such programs of assistance. The Institute was therefore happy to collaborate with the Water and Energy Commission Secretariat (WECS) of Nepal in examining ways to assist and improve such systems. Nepal is a country where an especially large proportion of irrigation systems is farmer-managed.

The program described in this volume aimed to improve and expand systems already managed by farmers, while ensuring that farmers retain their full responsibility for management. This work suggests, as an alternative to full-system rehabilitation, a strategy of providing minor financial and material assistance so as to strengthen local management capability.

A vital feature of such a strategy is that it recognizes the management dimension. It does not just focus on physical improvements to facilities, but works to strengthen existing farmer institutions, such as water rights and resource mobilization arrangements. This is in welcome contrast to introducing

non-traditional practices and thereby confusing and weakening farmers' institutions, leaving them too often in a state of dependency on the government.

WECS tested its strategy in an action-research mode. It brought together experiences of assistance programs in Nepal and other countries, and experiences of existing farmer-managed irrigation systems. A set of procedures for physical and managerial improvements to existing systems was thus evolved. Modifications will be necessary in order to adapt these innovations to other environments; but the essential ideas underlying the strategy should find wide application.

IIMI has found its association with WECS in these activities informative and rewarding. The project has delivered significant benefits to farmers dwelling in difficult terrain with rather meager resources.

Charles L. Abernethy
Director of Programs
IIMI
September 1990

Acknowledgements

THE ACTION-RESEARCH PROJECT was initiated by the Water and Energy Commission Secretariat (WECS) with support from the Ford Foundation and the International Irrigation Management Institute (IIMI). Mr. B.K. Pradhan, then acting Executive Secretary of WECS, gave direction and vision to the project which was completed under the direction of the Acting Executive Secretary, Dr. C.K. Sharma. The Executive Director Mr. S. B. Upadhyay initiated the field work, which was completed by the Executive Director, Dr. Hari Man Shrestha. The management of project implementation was done by the Senior Hydrologist, Mr. D.R. Tuladhar. Mr. K.P. Rijal, the Senior Engineer, gave major assistance in managing the construction activities in the final year. Mr. S. Joshi, engineer and Mr. D. Adhikari, sociologist were employed by WECS to implement part of the work. The WECS engineer, Mr. B.K. Pradhan, monitored part of the construction implementation and the accountant, Mr. Gopi Shrestha assisted with financial control. The Hydro-Engineering Services conducted the fieldwork for the project identification phase and two consulting firms, the Hydro-Engineering Services and B.N. Acharya provided staff for design and field supervision of the construction and also provided valuable input to improving the farmers' management practices. Dr. Robert Yoder, Head of IIMI Field Operations in Nepal and Dr. Prachanda Pradhan, IIMI Irrigation Specialist, provided continuous support. Mr. Naresh Pradhan, IIMI agriculturalist/social scientist, was responsible for documenting the fieldwork.

He and Mr. Matrika Bhattarai, IIMI field assistant, organized a series of farmer-to-farmer training tours. Farmers in Chherlung and Argali of Palpa District were hosts to frequent farmer-to-farmer training teams that visited their irrigation systems. They provided hospitality along with effective management training from which many of the lessons of this project emerged. The farmers of the systems that participated in the project in the Indrawati Basin were most patient and helpful in providing information and commenting on new ideas.

The text of this document was prepared by Dr. Robert Yoder with assistance in the analysis of the results from Mr. Naresh Pradhan. Dr. Prachanda Pradhan assisted in preparing the list of lessons learned from the project. Many valuable comments from all who participated in implementing the project have helped shape the views that are presented.

Summary

FOR CENTURIES, FARMERS in Nepal have been developing the land and water resources of the country for irrigated agriculture. While some of the farmer-managed irrigation systems are performing at the level estimated as necessary to meet the basic needs of Nepal's growing population, many systems are not fully utilizing the resources at their disposal. Research on farmer-managed systems in recent years has indicated strategies that could be employed to improve the value of assistance being given to improve and expand these systems. An action-research project was formulated to develop and test procedures for doing this.

The Indrawati River Basin in Sindhupalchok District was selected for the project location. An irrigation resource inventory identified 119 existing systems in the project area. Of these, 19 systems irrigating a total of 625 hectares (ha) were determined to have the potential for expanding the area they serve by more than 50 percent and were selected for assistance. Although assistance to systems where area expansion is not possible would reduce maintenance costs and in some cases enable an additional crop each year by delivering more water with higher reliability, only systems with potential for expanding the command-area were selected for assistance by the project. This gave some families presently without irrigated fields access to irrigation and it was assumed to result in larger increases in food production than in situations where area could not be expanded.

Rapid-appraisal techniques were used to collect information about the physical and agricultural systems and about the organizations' management practices. While all of the systems selected required improvement of their physical infrastructure (e.g., enlargement of canal sections through rocky cliffs, construction of retaining walls and stream crossings, and lining segments of the canals), it was concluded that the absence of strong users' groups was a major factor in the farmers' inability to improve their systems by themselves. These systems lacked an organization able to carry out cooperative action for maintenance, to establish rules, to elect leaders, and to enforce sanctions.

In the second phase of the project, improvements were designed and implemented. Farmer participation in the design and implementation was mandated to ensure that operation and maintenance activities remained the responsibility of the farmers. In a public assembly to which present and future water users were invited to attend, the farmers selected a management committee to be responsible for day-to-day construction activities and continued management of the system.

As a part of the design process, the farmers were asked to help rank all of the desired physical system improvements into three groups according to priority: 1) highest priority was placed on improvements necessary for expansion of the system, 2) second priority was assigned to work that would improve system operation and maintenance, and 3) third-priority improvements included work that the farmers could accomplish using their own skills, labor, and materials. The project allocated funds to cover the cost of only first-priority activities. In a public meeting, the irrigators were informed that all the money allocated would be spent in their system, and if the farmers could save money on first-priority work, they would be able to use it for second- and even third-priority work. This proved to be an effective incentive for farmers to reevaluate priorities and it encouraged efficient implementation.

While the effort required to get farmer participation was substantial and increased the cost of supervision, the results clearly indicate that participation increased the value of the money spent. All of the first- and most second-priority work were completed. Assistance for both physical and management improvements made the systems more sustainable. The average cost of improvements including supervision in the 19 systems was NRs3,300/ha (US$150/ha).[1] More important than the low cost is the increase in food production resulting from better management.

[1]Costs are computed in Nepalese Rupees (NRs) at the exchange rate of NRs22/US$. This is the exchange rate that was in effect when the project grant was received in 1986.

Lessons Learned

GENERAL

Assistance to farmer systems is an opportunity for low-cost expansion of agricultural production

If farmers have built an irrigation system, several necessary conditions have been initiated — but not necessarily fulfilled — for effective low-cost investment for improving irrigated agricultural production: 1) land and water resources have been identified, 2) a willingness to invest their own resources has been demonstrated by farmers, and 3) some level of water users' organization has already been created. Assistance can capitalize on these existing conditions and focus on improving them further, at lower cost than building a new system.

Minor inputs can bring about major increases in agricultural production

In many existing farmer-managed systems, minor inputs from outside the community can increase the area irrigated or improve the reliability of irrigation to the existing area so that agricultural production will increase. Farmers can quickly identify necessary physical improvements but seldom understand that their major constraint is organizational. Often, providing training to farmers in improved management skills enables them to use their resources more effectively, which can also result in increased production. Assistance for physical improvements can be used to provide farmers with experience in managing many of the activities they need to perform for effective operation and maintenance of their system.

Assistance must be tailored to match priority needs in each system

Farmer-managed irrigation systems have evolved a range of institutions — organizations, rights, water-allocation principles, water-distribution practices, and procedures for conflict management — to fit the particular environment of each system. This evolution is never complete and the first task in providing assistance is to accurately understand and gauge the strengths and needs of these institutions. Because of environmental differences and differences in personal preferences, the necessary institutions for effective irrigation do not lend themselves to a blueprint approach that once developed, can be transferred and reproduced in each new setting. Assistance must be tailored to match the local institutional and physical needs in each system.

Combining the diversions of several farmer systems is usually not successful

In many communities, farmers have built a series of diversions from the same stream to irrigate contiguous command areas. Attempts by assistance projects to build one intake with a permanent structure to serve all systems have seldom been successful. Issues of prior investment and water rights make it difficult for farmers to accept such solutions if imposed upon them, even if in theory they are technically more efficient. Although the separate intakes and parallel canals appear to be inefficient with respect to maintenance and investment, they do provide a level of redundancy that allows sharing of water in times of emergency and leakage from higher-elevation canals is picked up by lower ones.

Assistance should improve only highest-priority items

Assistance for improvement of only the highest-priority items on the farmers' long list of wishes and needs is cost-effective, makes precise determination of the amount of assistance less important, and strengthens the farmers' organization by encouraging them to contribute their own resources. Although it was not intentional that the Water and Energy Commission Secretariat's action-research project could not fully fund all improvement work in each system assisted, it proved to be valuable in encouraging the farmers to make effective use of what they did receive.

Effective assistance, even if minimal, is valuable to farmers

Providing even a low level of assistance is of importance to farmers as a rallying point for mobilizing their own resources.

FARMER PARTICIPATION

Meaningful farmer participation requires substantial time, flexibility, and intensive technical supervision

Getting meaningful farmer participation for improvement of their system often requires: 1) substantial investment of time for organizing and training the farmers; 2) flexibility in timing of construction work to accommodate the farmers' agricultural activities; and 3) intensive technical supervision to train farmers in construction techniques and to guide them in carrying out the tasks.

Farmer participation results in: cost savings, mobilization of farmer resources, sense of ownership, and improved ability to manage

Farmer participation results in: 1) rapid completion of physical improvements; 2) substantial cost savings compared to estimates from the design norms; 3) mobilization of farmers' resources for completion of physical improvements beyond those covered by the outside assistance; 4) increased sense of ownership or awareness that the irrigation system is of their own creation and that it can be effectively operated and maintained by themselves; 5) improved ability to manage irrigation activities such as equitable water distribution and mobilization of labor and cash to maintain the system; and 6) intensification of irrigated agriculture and the expansion of the number of beneficiaries receiving access to irrigation.

Farmer participation is reduced if contracts awarded benefit individuals

Requiring the water users' organization to help administer the project as a way to strengthen it may be of more long-term value than the physical improvements. If the water users do not have experience that enables them to

be effective managers of the assistance program, intensive effort must focus on enabling them to build their capacity. To accomplish this, only the water users' organization as a body should be allowed to contract for improvement of the system. It can then divide up the many tasks to be accomplished as piecework among its members. Farmer participation is reduced if contracts awarded benefit individuals even if they are members of the users' group. Contractors prefer to bring in both skilled and unskilled labor from outside the community. This isolates the farmers from the construction process and deprives them of the opportunity to learn management and construction skills.

Farmer participation and confidence are increased if accounts are open to public inspection

Transparency in the accounts and all financial transactions (accounts open for all to inspect) dispels rumors, improves control and gives confidence to farmers that they are being dealt with fairly. Rival factions which exist in most communities can work together if it is clear to each that the other is not getting undue advantage. This greatly facilitates farmer participation.

IDENTIFICATION AND SELECTION OF SYSTEMS

An irrigation resource inventory identifies systems to assist

A detailed irrigation resource inventory that identifies the water and land resource utilization of each irrigation system in a watershed allows immediate identification of systems where assistance will: 1) allow expansion of the irrigated area, 2) allow increased cropping intensity on existing irrigated area, and 3) show where operation and maintenance costs can be reduced, making a system economically viable.

Information from an inventory allows sorting and ranking of systems

Information from the detailed inventory allows sorting and ranking of systems in an area using simple criteria to determine to which systems limited available assistance resources should be given to achieve the greatest increase in food production.

Clustering systems for assistance on a watershed basis facilitates supervision

Inventory information on a watershed basis allows systematic clustering of systems for assistance which facilitates supervision, reduces travel costs, and improves logistics for supplying construction materials.

PROJECT IMPLEMENTATION

A rapid-appraisal study can provide information on physical and management needs

A rapid-appraisal study of existing farmer-managed irrigation systems selected for assistance can provide information on: 1) the strength of the existing water users' organization — whether it is already fully able to deal with system improvements if given resources, or if improving the organization needs to be the first assistance strategy activated; 2) essential structural improvements necessary for improved performance and a sense of the farmers' priorities in making the improvements; and 3) sufficient design information for a first approximation of the cost for making the essential improvements.

Most designs for farmer systems should be done in the field

Gathering sufficient data for an office-oriented design is far too expensive for most of the simple structures that need to be constructed in farmer-managed systems. Results of such attempts require a high degree of modification and time-consuming redesign to achieve farmer acceptance. Skilled technicians interacting with the farmers can accomplish most design work in the field and on the spot where the improvement is to be made. This results in immediate farmer acceptance and far lower incidence of design changes during implementation.

Design of physical structures that farmers can operate and maintain requires the use of information from farmers and is an engineering challenge

Experienced and dedicated technicians are required to design physical improvements for farmer-managed systems. Although these systems generally do not require complex, sophisticated structures, simple and appropriate designs are more difficult and challenging to identify than complex conventional handbook solutions. Furthermore, flexibility in design is required to utilize the farmers' information and experience. Factors that enhance the farmers' ability to continue to operate and maintain the system must be included in the design. If existing farmer-built structures like brush/stone diversions are being replaced, the new structures must fit with the farmers' limited access to materials for maintenance.

Accounting and control procedures must facilitate implementation

Accounting and control procedures need to be examined to determine ways by which they can be modified to facilitate rather than hamper implementation. With accounts open to the public, the water users' group can take far more responsibility for monitoring and approving design changes, for procuring materials and tools, and for making labor payments.

Physical construction activities provide an opportunity for training the users' organization in management tasks

A strong users' committee with experience which recognizes that the irrigation system is its common property can usually mobilize and manage labor, handle accounts, and control construction materials and tools. An organization with less experience needs to be assisted with these tasks. Physical construction activities provide an excellent opportunity for training the users' organization.

Local, private consulting firms can implement a participatory design approach and supervise improvements by farmers if given good terms of reference

The use of private consulting firms for participatory design and supervision of improvements by farmers can be highly successful, but terms of reference must be carefully developed so that the responsibilities of the consultant are clear. All investment should be approved by the users' group, with the agency being the final authority.

Effective farmer training at low cost is accomplished through structured visits to well-managed systems

Farmer training can be accomplished effectively at a low cost by conducting structured exchange visits to well-managed systems. When farmers from a system receiving assistance have the opportunity to observe a well-managed system firsthand and can interact with the host farmers, the transfer of technical and managerial knowledge is greatly facilitated and enthusiastically received.

Farmers with years of experience in operating and maintaining a well-managed system are good consultants for advising less-experienced farmers

Hiring farmers with many years of experience in operating and maintaining a well-managed system as consultants to advise on physical and management improvements is cost-effective and provides valuable inputs that the farmers from the systems receiving assistance can easily comprehend.

CHAPTER 1

Introduction

THE IMPORTANCE OF farmer-managed irrigation systems in Nepal can be viewed from several perspectives. At the household level, survival of many families in densely populated hill areas depends on the increased production made possible by their irrigation system. At the national level, at least 45 percent of the population's subsistence cereal requirement is being met by the increase in food production made possible by irrigation from farmer-managed systems.[2] This estimate assumes a conservative annual increase in production of 2,000 kilograms per hectare (kg/ha) with irrigation as compared to rain-fed conditions.

Some farmer-managed irrigation systems are managed well, with intensive cultivation of three crops a year giving an annual production in the range of

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[2]Percent of subsistence cereal requirement of Nepal's population met by the increase in production from farmer systems is determined as follows.

Assume:

- Area irrigated by farmer-managed systems is 675,000 ha (HMGN Irrigation Master Plan 1988)
- Annual increase in production of cereal grain with irrigation is 2 tons/hectare/year (t/ha/yr) as compared to rain-fed conditions,
- Subsistence cereal requirement is 0.164 ton/person/year (t/person/yr),
- Nepal's approximate population is 18,000,000 persons.

Total increased annual cereal production from farmer systems

675,000 ha x 2 t/ha/yr = 1,350,000 t/yr

Total subsistence cereal requirement

0.164 t/person/yr x 18,000,000 persons = 2,952,000 t/yr

$$\text{Percent subsistence cereal production} = \frac{1{,}350{,}000 \text{ t/yr}}{2{,}952{,}000 \text{ t/yr}} \times 100 = 45.7$$

7,500 to 9,000 kg/ha (Yoder 1986). Other farmer-managed systems are operating far below the production level they could potentially achieve with their available water and land resources (Pant 1985; Tiwari 1986; Hydro-Engineering Services 1987).

If minor improvement to already operating farmer systems can increase their irrigated area or improve irrigation reliability to the existing area so that an additional crop can be grown, a rapid increase in food production will result. If assistance to these systems increases the operation and maintenance capacity of the farmers, it will enhance system sustainability.

Though a given system may be performing poorly, the fact that farmers have already constructed a canal means they have identified land and water resources, have had enough commitment to invest their own resources for irrigation development, and have formed at least the rudiments of a users' organization. These are the conditions that allow relatively low-cost assistance to existing farmer-managed systems to be effective.

The Water and Energy Commission Secretariat (WECS), with assistance from the Ford Foundation and the International Irrigation Management Institute, established a small action-research project in 1985 to investigate alternatives for providing assistance to farmer-managed irrigation systems that would expand irrigated agriculture. The WECS Executive Director for Water Resources had overall responsibility for implementing the project. Other senior WECS staff and the WECS accountant supported the field personnel.

OBJECTIVES OF THE ACTION-RESEARCH PROJECT

One objective of the action-research project was to establish low-cost procedures for identifying the relative needs of all systems in an area, allowing the selection of systems for assistance where the greatest impact on food production could be made. Another objective was to develop and test methods for delivering assistance that enhanced farmer-management capability for operation and maintenance at the same time as the physical infrastructure was being improved.

The goal of expanding existing farmer-managed systems included the proviso that they remained farmer-managed. It was assumed that this required full participation of the farmers in identification of the available resources and the limitations they have in exploiting them. Furthermore, it was anticipated

that farmer participation in carrying out all improvement activities under the guidance of competent technicians would give experience to farmers in physical system maintenance procedures and would teach management skills essential for mobilizing local resources.

This paper briefly outlines the main features of the action-research project and concentrates on the results and lessons learned. (For further reading on this project see: Acharya 1989; Hydro-Engineering Services 1989; Acharya 1990; Bhattarai 1990; and Pradhan and Yoder 1989.) The recommendations given are in the form of a set of procedures that could be followed in developing an implementation program in an environment similar to the action-research project area.

CHAPTER 2

Project Implementation

THE UPPER INDRAWATI River Basin in Sindhupalchok District was selected for the project site (see Figure 1). Proximity to Kathmandu for supervision of the research was the primary consideration in site selection. This is a hilly area where the Indrawati River has cut deep into the valley making water from this large snow-fed river nearly inaccessible to farmers for irrigation. To develop irrigation, farmers have constructed diversions on the small high-gradient tributary streams to the Indrawati River. These streams have destructive floods in the monsoon but only a small spring-fed discharge in the dry season. Farmers have built contour canals, often across rock cliffs and through unstable slopes, to irrigate terraced hill slopes.

At the lower end of the project area where the elevation is about 1,000 meters, three irrigated crops are grown each year. At the higher elevations, low temperatures limit the growing season to two crops. Rice is the main irrigated crop in the rainy season and if the water supply is adequate, an irrigated rice crop is also grown in the hot, dry season preceding the monsoon. If water is limited, maize may be grown instead of rice before the monsoon. Wheat or potatoes are the predominant irrigated winter crops.

To allow systematic identification of existing systems, the river basin hydrologic boundaries were used to define the project area. This reduced travel time and simplified supervision since it is the basin's drainage pattern that determines the location of systems, not administrative boundaries.

PHASE I: SYSTEM IDENTIFICATION AND SELECTION

The objective of determining relative needs among systems and establishing criteria for selecting systems to assist required that all the systems in the project area be identified and some minimum level of information collected about each of them. An inventory activity was used to fulfill this objective.

Inventory

Hydro-Engineering Services, a local consulting firm, was engaged to visit all tributary streams of the Indrawati River in the project area and identify each canal diversion point. Using farmer informants to describe the variation of discharge in the stream at the diversion in each season compared to that being observed, the water resource available throughout the year was assessed. The consultant was required to walk from the canal diversion to the command area of each canal with a group of water users and note difficulties that the farmers faced in operating the system. By asking a group of farmers, a rough estimate was made of the area irrigated for each crop and it was confirmed by visual checking. Identification of the extent and nature of unirrigated land that could be served by each canal and of the reasons why it was not presently receiving water was also accomplished with the help of the farmer group. It took a team of three persons 21 days in the field to complete the inventory.

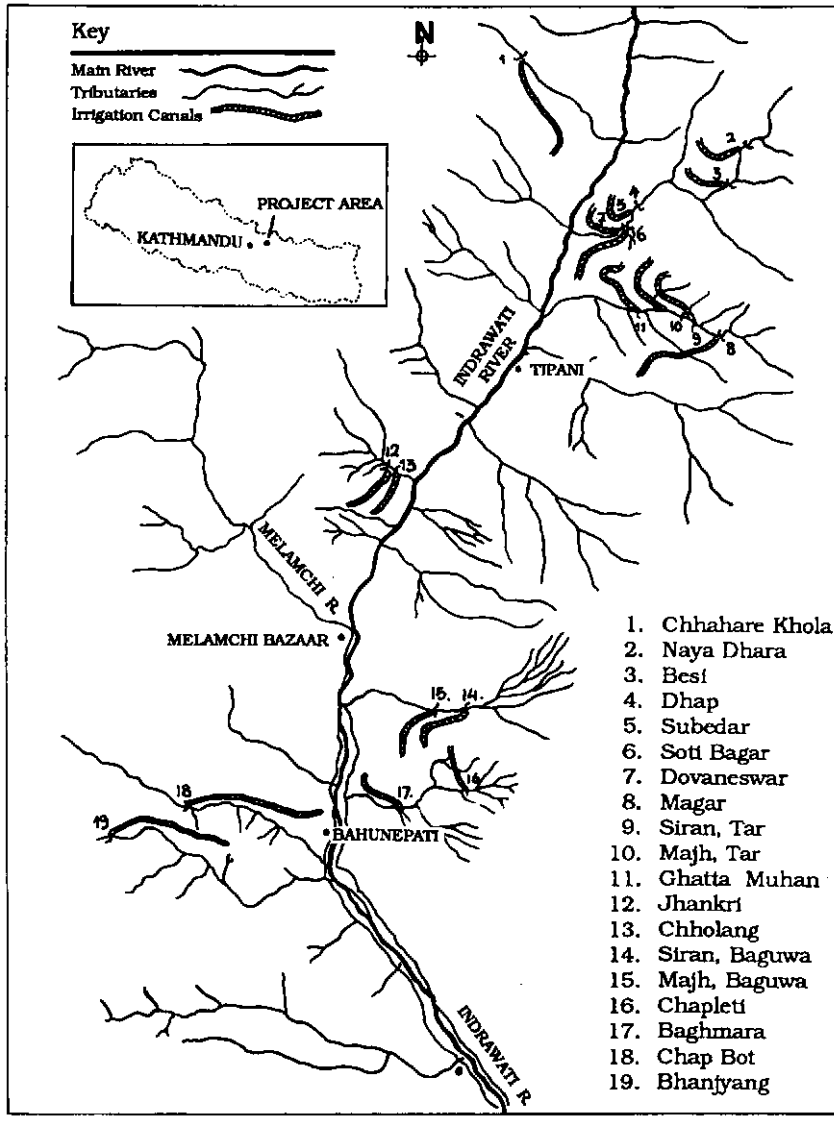
As a result of the inventory, 119 irrigation systems were identified with canals longer than 0.5 km in the 200-square kilometer project area (Hydro-Engineering Services 1986). These systems irrigate about 2,100 ha owned by more than 5,000 households.

A major accomplishment of the inventory was a description of the potential for either intensifying the cropping pattern or expanding the area irrigated by each system. Out of the 25 tributary stream basins which farmers have tapped for irrigation, only 23 separate irrigation systems in 11 subbasins were identified by the consultant as having both land and water resources with potential for expansion of the irrigated area.

System Selection Criteria

The main criteria established for selecting systems for assistance were water and land availability for irrigation expansion. Food production can also be increased by assisting systems where expansion of area is not possible but

Figure 1. Project area map showing the names and locations of the 19 systems that received assistance.



where an additional crop could be grown each year by making the water supply more reliable. Sustainability of some systems where the area irrigated and cropping intensity have already been maximized is threatened by high maintenance costs. Many systems would benefit from assistance to build permanent structures and reduce the maintenance burden.

However, because of limited resources, only systems where expansion of irrigated area was possible were selected because this would have a high impact on food production and benefit families not presently having access to irrigated land. Of the 119 systems, only 23 systems, or 19 percent, met this criterion. Additional criteria for selection were that the existing users had to be willing to allow their system to be expanded and be willing to accept additional farmers as members of the water users' organization. After using the inventory information to identify systems that had potential for expansion and where existing users were willing to give water rights to new users in an expanded area, the selected systems were revisited and examined in greater detail using rapid-appraisal techniques developed by the project.

Rapid Appraisal

The same local consulting firm that had conducted the inventory also carried out the rapid-appraisal study using the same field team. The team measured the discharge in the water source at the diversion and compiled a detailed description of all problems along the canal. They also developed a more complete profile of the existing agricultural and irrigation practices. The information from the inventory and rapid-appraisal studies was used to make the final selection of the 19 systems for assistance.

A major problem identified during rapid appraisal was that the water users of the systems selected for assistance did not function as organized bodies to manage the operation and maintenance activities of their canals. Labor mobilization for maintenance was not systematic, and in many cases it was unclear how many households actually received water from the canal for irrigation. Cash mobilization for making system improvements or paying someone to patrol the canal daily was unknown. Only one of the systems had any written records — and that was for only a few days of labor mobilization. This was in sharp contrast to well-managed farmer systems studied in many other districts of Nepal (Khatri-Chhetri et al. 1988; Martin and Yoder 1988b; and Pradhan 1989). The systems selected for assistance by the action-research

project had only recently begun development of their institutions — i.e, formulating rules, rights, and obligations, and organizing themselves to make decisions and manage irrigation tasks. From the results of the action research, it is clear that the primary reason these systems had not developed the full extent of their land and water resources was the lack of a strong users' organization rather than technical or economic difficulties. During the rapid-appraisal study, farmer training for irrigation management in each system was identified as a priority in implementation of the project.

PHASE II: IMPLEMENTATION OF IMPROVEMENTS

The rapid-appraisal report identified far more work to be done than the available project money could cover. One option was to reduce the number of systems assisted to allow full funding for a few. Another alternative was to only provide assistance for the most urgent needs in each system. Since it was noted that some work was essential for system expansion, while other improvements reduced maintenance or made the system easier to operate, it was decided to divide all improvements into three categories according to priority: 1) first-priority work was essential for expansion but difficult for farmers to do without assistance, 2) second priority included work desirable for improved system operation and maintenance, and 3) third-priority work was identified as improvements farmers could accomplish with their own resources — skills, labor, and materials.

The project-assistance funds were allocated among the irrigation systems in proportion to the estimated cost of completing the first-priority work. Most first-priority improvement costs were covered. Once the allocation of funds was made, a fixed amount of money was available to each system. As an incentive to the farmers, the project decided that if farmers could save money by working efficiently, or by paying themselves lower wages, or by donating labor, they would be able to use the savings for additional, second-priority or even third-priority work within the system, i.e., all the funds allocated to a system would be used in that system rather than stopping assistance when the first-priority work was complete.

In order to gain a perspective of different styles and modes to implement the assistance program, the 19 systems were divided into three clusters. Supervision of assistance for one cluster of four systems was handled by staff

hired directly by WECS. Implementation in the other two clusters was supervised by local consulting firms. One of these was supervised by the firm which had already completed the inventory and rapid-appraisal studies. Actual field supervision was carried out by teams that consisted of engineers, overseers, agriculturalists, social scientists, and persons with construction skills. The term "field supervisor" is used here to refer to any of the persons on the supervision teams responsible for directing the implementation work.

The terms of reference prepared by WECS for supervision of assistance emphasized building the capacity of the water users' organization to manage operation and maintenance. The construction activities were to be a training exercise for the users' organization in making decisions, establishing rules, managing conflicts, mobilizing labor, and keeping records. The project directives mandated that all activities be carried out by agreement of and assistance from the water users. This was to ensure that the "farmer-managed" character of each system be preserved, i.e., that all operation and maintenance activities remained the responsibility of the farmers after completion of the assistance.

Dialogues

The field supervisors initiated a series of dialogues with the water users of each system. These consisted of meetings to which all users of the irrigation system were invited. The first dialogue was used to communicate to the irrigators that their system had been selected for assistance under certain conditions. In the second dialogue, the water users were informed of the amount of money available to their system and the priority of the work to be done was examined. In many cases the priorities were modified.

The terms and conditions discussed in the first dialogue included a requirement that the water users form a users' organization unless one already existed, and listed the activities that the users' organization was responsible for fulfilling. This list included: 1) identification of existing and future water users (from the expanded area) and the land area each irrigated, 2) preparation and acceptance by all water users of a plan for water allocation to the new area, 3) preparation of a plan, including rules, for supervising the improvements to be made and for future management of operation and maintenance, and 4) setting requirements and rates for free and paid labor mobilization.

The terms and conditions also stated that the users' organization would assist the field supervisor in carrying out the site investigation and design work and that the users would provide all the labor for transporting materials and making the physical improvements. All labor provided by the water users would be paid for by the project at the rate set by the users of each system as long as the rate was within the government guidelines. The project would provide materials not locally available, including the cost of transportation.

All water users of the existing system and from the area to which the system was to be expanded automatically became members of the organization. The organization then had the authority to decide on the number of members required to form a quorum and to determine the basis for making binding decisions. In the first dialogue, the farmers were told that all activities would be carried out on the basis of the decisions made by their organization.

The users' organization was required to form a management committee to take care of day-to-day implementation activities and to continue as the manager of operation and maintenance after completion of the improvements. Each system determined the number of functionaries it wanted, described the responsibilities and accountability of each, and elected individuals to fill the positions. These persons were not to be paid from the project-improvement fund.

Design

Between the first and second dialogues, the field supervisors worked with the farmers to collect design data and complete the design work. A field-design book was opened for each system to record all measurements and sketches for each structure, including where appropriate, the alternative designs considered. The advice and suggestions of the beneficiaries were also noted. Emphasis was placed on maximizing the use of local materials and the existing canal alignment. The field supervisor provided the farmers with information about costs and relative labor requirements for alternative designs. On the basis of this information, in consultation with the field supervisor, the water users decided on the priorities for making physical improvements.

While it was specified that the design work should be field-based with full participation of the beneficiaries, it was also necessary to comply with the rules and regulations of the government. This required design drawings of each structure and cost estimates based on the national norms published by the

Ministry of Works and Transport. As a result, while design data were collected with farmer input, design drawings and cost estimates were done in a Kathmandu office away from the site without benefit of farmer input or reinspection of the site. Even though most structures were simple in nature, the drawings took a great deal of time, and in the end, required substantial changes to comply with the project objectives, i.e., meet farmer approval.

Physical Improvements

A construction book was established for each system. It was used to record meeting minutes and all decisions regarding the modification of designs and procedures. It was also used to record a summary of each day's work, daily labor mobilization, quantities of local materials collected, costs for transportation of materials, and all transactions for cash and construction materials. The unique feature in this process was that the construction book was open for inspection by all farmers, the consultant, WECS, and IIMI staff.

Supervision of the physical improvements varied among the clusters but all received intensive supervision. In each case, a field supervisor was in charge at the site. Usually, this was a person without extensive experience or technical skills, but who could follow the directions given by the engineer and assist with record keeping. This field-level supervisor stayed full time at a site for the four to eight months that construction was underway. An engineer or overseer visited frequently to check and instruct the farmers, but the field supervisor was there each day to see that the instructions were understood and carried out. In many cases, the field supervisor lived with the farmers and learned to know them well, came to understand community problems, and learnt to identify factions among farmers — all of which were essential in the process of motivating and helping the farmers build a viable water users' organization.

The field supervisors' job was to oversee completion of the physical improvements, ensure the integrity of the design, and control quality. However, they found that a major part of their time and effort was spent motivating the farmers to work as an organization. The field supervisors also had to assist the farmers with the technical and administrative work. WECS purchased and delivered materials such as tools, cement, and steel to the field, but coordination of delivery and transport from the road head to each system was done by the field supervisors.

Management Improvements

The major input to improving farmer management was provided by the field supervisors through daily contact in helping the management committee organize and carry out its work. Assisting the committee members in making group decisions, keeping records, and mobilizing labor constituted a continuous process for the duration of the construction period.

In addition, WECS and IIMI initiated a series of farmer-to-farmer training tours. It was possible for one to nine persons from each system to attend one of the five training tours. The objective was to expose farmers from the systems being assisted to a variety of organizational and management options that other farmers in well-managed systems had developed. On a typical tour, first an inspection was made of the intake and canal of the system visited. Then, a meeting was held where the host farmers described the ways they had devised to deal with issues such as labor mobilization for emergency maintenance, water allocation, water distribution, conflict management, and the structure of the organization. A facilitator listened to the discussion and interjected questions periodically to ensure that all topics were adequately covered. Since the systems that farmers visited during the farmer-to-farmer training were difficult systems to build and maintain, they provided an example of what can be accomplished through the organized effort of farmers. This created a great deal of enthusiasm among the visiting farmers when they realized that most of their own systems faced fewer physical obstacles and that they could achieve the same level of intensive irrigated cropping.

To provide another mode for farmer-to-farmer input, the project hired farmers from well-managed systems as consultants to visit systems in the project area. The organizations of two well-managed systems chose four experienced irrigators as their representatives. In addition to experience, selection was based on ability to interpret observations and communicate authoritatively. The farmer-consultants inspected the canals and structures of nine systems and discussed their observations of similarities and differences to their own systems with the farmers in each system, and made suggestions for improvements.

The observations and input of the farmer-consultants at each system reflected their perception that it was not due to the lack of resources or difficult technical problems that these systems were not functioning well, but rather that the water users had not developed a strong organizational structure that enabled

them to make and carry out decisions that benefited all users equitably. The farmer-consultants' report at the end of their ten days of work indicated some frustration that government assistance was being provided to irrigation systems where physical improvement was relatively easy. They identified the irrigators' unwillingness to sit down and work out personal differences and to work cooperatively as the main reason the systems had not been improved by the farmers themselves. In the farmer-consultants' own systems, they had overcome more difficult technical problems with much less outside assistance. When it was pointed out to them that they had been hired as farmer-consultants because they could communicate this self-help attitude so well, they accepted the rationale with great pride.

Problems Encountered during Implementation of Construction

Most government-assisted rural works in the project area have been carried out through local labor contracts in the past. The labor contractor often hired persons from outside the community if those from the community were not willing to work for the wages he dictated. In many communities, farmers told stories of being cheated out of their wages when they worked for a contractor. In most cases, they had only heard rumors regarding the amount of the contract, never a public declaration by a government official. Because they felt that the contractors made a huge profit at their expense, they were reluctant to participate. It was initially difficult to convince the farmers that this project would be different. Timely labor payments, accounts open for all to inspect, and the sincerity of WECS and consultant staff were the main factors in overcoming these fears. In several cases, local leaders who were initially enthusiastic about the prospect of a project lost interest when they realized they would not be able to win a lucrative contract.

Due to the isolated nature of the work site — from the road, a full day of walking — there were periodic communication problems, delays in the flow of construction materials, and sometimes payments did not reach the site in time, causing discontent. This placed a heavy burden on the site supervisor who was responsible for keeping the work moving. The WECS support staff overcame these problems by establishing good rapport with the farmers, flexible work schedules, and strong commitment to completion of the work.

The project objective stated that all activities had to be carried out with the agreement of the water users. Therefore, the designs had to be acceptable to the farmers. Since the farmers could not read design drawings nor easily understand a verbal description which involved terms and quantities they were not familiar with, they often had agreed to designs that they later rejected when construction was to begin and the work actually laid out at the site. In part, this was because the farmers were reluctant to accept structures with which they were not familiar. In other cases, the farmers felt the structure might limit the discharge. In general, they wanted a type of structure that would allow continued increase in discharge beyond the design capacity in case water became available for further expansion of the command area or for other uses such as a water-powered mill.

Changing a design typically requires preparation of the new design and related drawings, a new cost estimate, and approval of both by higher authorities who are at a central office far from the work site. This must be understood in the context of an isolated work site where telephone and two-way radio communications are not available, and reaching the site requires considerable walking. Changes can cause long delays which are particularly annoying and expensive when a project has already mobilized labor and materials and is ready to build the structure.

Because farmers frequently demand time-consuming design changes when they actually see what is to be constructed, project staff in government projects often prefer to use a contractor who will carry out the work according to the design regardless of objections from the farmers.

To expedite construction in this project, the WECS Executive Director of Water Resources delegated authority to the two senior WECS engineers to approve design changes in the field if the request was made by a majority of the water users. This allowed a great deal of flexibility during implementation and a substantial number of design changes were made. However, even with a rapid, flexible process for changing and approving designs, it always caused delays for those supervising the field work.

Of the 150 first-priority structures designed for the 19 systems, 41 percent were redesigned as a result of farmer requests during construction, and 7 percent were dropped in favor of using the money for modified priorities. Through farmer participation and intensive construction supervision, enough money was saved in implementation of the first-priority work to allow an additional 140 structures and activities to be completed.

CHAPTER 3

Results

CONSTRUCTION AND COST

TABLE 1 SHOWS that assistance to the 19 systems allowed expansion of the irrigated area commanded by the canals by over 50 percent. The cost based on the grant to each system was just under NRs2,000/ha (US$91/ha). With supervision included, the cost of physical and management improvements was about NRs3,300 (US$150) per hectare. This is in the same cost range as other agencies that have provided assistance[3] to farmer systems in the hills using participatory methods such as the Farm Irrigation and Water Utilization Division with costs averaging NRs3,400/ha, and the Agricultural Development Bank of Nepal which costs about NRs4,600/ha (HMGN Irrigation Master Plan 1988b).

More important than the low capital cost per hectare of the grant was the effect of intensive supervision and farmer training tours in motivating farmers to use the grant resource productively and to augment it with their own labor. This resulted in nearly all of the improvements identified by the farmers and consultant (including second- and third-priority work) being completed even though the budget was expected to cover only the improvements of first-priority work. Table 2 shows that farmer involvement in the construction resulted in a 38 percent saving over the estimated cost of the first-priority work. Although the project was not based on a mandatory contribution from

[3]Assistance here implies provision of minor inputs and farmer involvement in making the improvements. The Department of Irrigation tends to use a rehabilitation approach where major input, usually through contractors, is given to improve a system to accepted standards with methods that would be applied to buildings a new system.

the farmers, about half of the systems managed substantial labor mobilization from their own resources. One system contributed 30 percent of the total investment in their system.

Considering the average of all the systems, farmer participation can be credited with increasing the value of the grant by about 134 percent, where the volume of work completed is computed at the rates given in the national norms for rate analysis. Most of the increases in value of the work done can be credited to the efficiency of work accomplished by farmer participation over what would have been required if contractors had been used.

Although a great deal of time and effort were required to bring about effective farmer participation and the project got off to a slow start with delays for design modifications, ultimately it resulted in an extraordinary farmer response during construction. Once farmers were convinced that they were getting what they needed from the project, they worked hard to gain the maximum benefits possible.

MANAGEMENT CHANGES

In addition to effective construction output, the farmers gained confidence and pride in their own ability to organize and mobilize resources and also gained skills in construction methods. This has improved their ability to continue management of operation and maintenance of the systems. While the savings in cost of physical improvements attributable to farmer participation are valuable, the real payoff is in the sustainability of those improvements and better water delivery from improved management.

Research has shown that the strength of farmer-managed irrigation systems is the ability of farmers to cooperate in the management of their systems (Martin and Yoder 1988). This allows them to overcome some of the limitations of temporary structures made with local resources in difficult terrain. Management of operation and maintenance activities in all the 19 systems assisted was on an *ad hoc* basis before improvements. There were few examples of cooperative effort for maintenance and no evidence of rules, roles, and sanctions that are common features in well-managed systems. There is evidence that the assistance project has brought some level of management change in all the 19 systems.

Table 1. Irrigable area and cost of improvements to 19 farmer-managed systems.

System	Existing command area (ha)	Command area expansion (ha)	Total irrigable area (ha)	Project grant (NRs)	Cost per irrigable hectare (NRs)
Chhahare Khola	126	37	163	126,615	777
Soti Bagar	19	11	30	150,699	5,023
Dovaneswar	2	10	2	74,807	6,234
Magar	100	43	143	160,805	1,125
Siran, Tar	18	6	24	136,789	5,700
Majh, Tar	71	16	87	114,321	1,314
Ghatta Muhan	23	10	33	124,321	3,767
Jhankri	18	13	31	91,707	2,958
Chholang	23	14	37	116,066	3,137
Siran, Baguwa	18	19	37	57,488	1,554
Majh, Baguwa	13	20	33	113;541	3,441
Chapleti	8	15	23	78,065	3,394
Baghmara	3	6	9	44,433	4,937
Chap Bot	12	5	17	71,630	4,214
Bhanjyang	21	14	35	65,178	1,862
Dhap and Subedar	30	35	65	85,000	1,308
Naya Dhara	55	55	110	139,720	1,270
Besi	65	20	85	119,839	1,410
	625	349	974	1,871,024	
Average cost per irrigable hectare					1,921
Consultant and WECS supervision support				1,192,747	
Tools supplied				82,182	
Farmer training				55,000	
				1,329,929	
Average cost of supervision per irrigable hectare					1,365
Total cost of improvement per irrigable hectare					3,286

Table 2. Savings in cost of improvements due to farmer participation.

System	(a) First-priority work Grant	(b) First-priority work Actual expenditure	Saving	(c) Farmers' contribution	(d) Work completed	(e) Effective increase d/a
	(NRs '000)	(NRs '000)	(a-b)/a (%)	(NRs '000)	(NRs '000)	(%)
Chhahare Khola	127	62	51	3	168	132
Soti Bagar	151	83	45	1	167	111
Dovaneswar	75	68	9	1	89	119
Magar	161	133	17	1	192	119
Siran, Tar	137	40	71	1	214	156
Majh, Tar	114	96	16	1	143	125
Ghatta Muhan	124	82	34	0	170	137
Jhankri	92	28	70	1	108	117
Chholang	116	41	65	1	136	117
Siran, Baguwa	57	42	26	25	81	142
Majh, Baguwa	114	85	25	42	170	149
Chapleti	78	60	5	19	109	140
Baghmara	44	30	32	12	73	166
Chap Bot	72	60	17	16	86	119
Bhanjyang	65	50	23	15	102	157
Dhap and Subedar	85	35	59	4	154	181
Naya Dhara	140	-	-	21	245	175
Besi	120	-	-	10	221	184
Total	1,872	995	38[f]	174	2,628	140

a Grant amount allocated to the systems to complete most first-priority work as estimated using national norms.

b Grant money expenditure for completing first-priority work — money saved (a-b) was used for second- and third-priority work.

c All unpaid labor (calculated as the number of person-days of labor multiplied by the district wage rate) plus the difference between the district rate and a lower wage rate as agreed to by farmers in some systems to reduce cost.

d Value of work completed as computed using national norms. This is higher than (a+c) because: 1) estimates computed by norms are generally high, and 2) work efficiency due to farmer participation was very high.

e Effectiveness of farmer participation in accomplishing more than estimated by the national norms.

f Naya Dhara and Besi Kulo systems are not included because information on the actual cost is not available.

A survey was made of the 19 systems after they had operated through one monsoon to determine if any of the management innovations introduced during the assistance program were being used. In all the systems there was a stronger feeling of ownership of their system by more of the farmers than before the assistance. In 11 systems the leadership has changed, but in all systems they were able to refer to an elected leader. In all systems there was evidence of more organized activity than prior to the assistance program, and a number of systems have become highly organized.

The system with the strongest organization reported that they were following all of the rules they had made collectively. In eight other systems, the farmers indicated that the rules they had made are operational. The other ten systems had nothing to report when asked about rules. In a number of systems, they have realized that some farmers have been able to irrigate without making a contribution to system improvement. Now that most have made a contribution, social pressure is increasing for equitable labor input for maintenance. In two systems, those who repaired the system refused to allow water to be used by families who did not fulfill their share of the labor requirements. The organization has made arrangements to allow delinquent farmers to do additional work on the canal or make cash payments to earn their place as members.

In nine systems, formal meetings with recorded minutes have continued after the project was completed. Seven other systems also held meetings but did not keep records. The other three systems have not held meetings. One system reported that over 90 percent of the water users had attended their assembly meeting and two reported attendance as low as 50 percent. The rest indicated that more than two-thirds of the users attended at least one meeting after completion of the construction. It was reported that the main purpose for meetings was to discuss labor mobilization for canal maintenance. There were also cases where meetings were held to discuss water allocation, water distribution, and to resolve a conflict. In the two systems where they have continued to keep the accounts open for inspection by all users as was initiated during construction, meetings have been called to discuss the accounts.

In all systems there has been more cooperative effort to maintain the canal during the monsoon. In three systems, persons were hired and paid — in two systems they were paid in kind and in one system in cash — by the organization to patrol the canal to take care of minor maintenance and report the need for emergency maintenance. All but a few systems with alternative sources for

monsoon irrigation reported that there was effective labor mobilization for emergency maintenance.

There will need to be a continued adjustment to the rules as each organization determines its needs and the mode in which it wants to operate. Now a mechanism is in place in each system for doing this. The real management test will be passed if this evolution continues until workable modes of operation and maintenance are institutionalized. The impact of better system operation on increasing agricultural production is providing an incentive for these changes.

AGRICULTURAL CHANGES

Following the first rice harvest after completing the assistance, farmers were interviewed in each system and asked how much more water was now available as compared to before the improvements were completed. The system with the lowest report indicated a 40 percent increase in water delivery. Three other systems reported a 50 percent increase each. All the rest said that the water available at the command area had at least doubled. When the same farmers were asked what impact the increased water supply had, the most frequent response was that it allowed timely rice transplanting. In the past, they had to wait for rain to transplant. In several systems farmers reported that head-end versus tail-end irrigator conflicts over water distribution no longer existed. In several systems, the increase in water delivery allowed the installation of a water-powered grain processing mill.

Assistance for physical improvements was completed just before the monsoon rice season in 1989. No time was available for most farmers to convert their upland fields into level terraces for growing rice. Farmers in one system reported that on the few hectares they were able to terrace, production shifted from an average of 1.7 tons per hectare (t/ha) of millet to nearly 3.0 t/ha of rice. Farmers indicated it will take them four or five years to complete the terrace building, but wide-scale work was observed to be underway.

Seventy-six of the farmers interviewed after the monsoon rice harvest indicated they had previously grown rain-fed rice on land that they were able to irrigate for the first time after the system was improved. The total sample of 16 ha that shifted from rain-fed to irrigated rice reported an average increase

in yield of about 50 percent, from 1.5 to 2.2 t/ha. A sample of 106 farmers with over 44 ha of rice land that had intermittent access to irrigation in the past reported that on the average, their yields rose from 1.2 to 2.3 t/ha, or an increase of about 90 percent. Many farmers indicated that their yields this year were reduced due to a severe hailstorm and that they expect to get a much higher return in future years. In this first cropping season, farmer practices regarding fertilizer did not change. All the increase in production was due to improved irrigation. As reliability is proven, farmers will use fertilizer and other inputs resulting in even higher impact. Active agricultural extension could shorten the time required to achieve full production.

A survey of changes in winter crop production in 14 of the systems is shown in Table 3. It shows the increased area of various winter crops due to improved irrigation. The largest expansion of irrigated area is for wheat but the value of potatoes grown on the expanded area was the highest. Table 4 shows the estimated value of production resulting from improved irrigation. It assumes that the area growing potatoes grew millet before irrigation. The average national yields for crops in the hills in irrigated and unirrigated conditions and farmgate financial prices were used to estimate the value. Without including the value of vegetables, the increased production of winter crops alone in the 14 systems surveyed had a value of nearly one-fourth the cost of the improvements made in all the 19 systems.

A more intensive evaluation is being undertaken by WECS in 1990 to determine the total impact on agricultural production. However, already there are clear indications that rapid change is taking place. If the trends indicated by the small sample of farmers reported here are correct and apply to the total project area, the value of increased production will be more than the cost of improvements within a few years.

Table 3. Area growing irrigated crops in winter season immediately before and after assistance (ha).

System	Potato		Oilseed		Wheat		Vegetables	
	Before	After	Before	After	Before	After	Before	After
Chhahare Khola	0.2	2.5	n.a.*	n.a.	n.a.	n.a.	0.1	1.6
Soti Bagar	0	0.6	0:2	2.5	6.0	15.0	0.2	0.4
Dovaneswar	0	0.5	0	0	1.0	2.0	0	0.2
Magar	0.5	2.5	0	1.0	n.a.	n.a.	0.5	1.3
Siran, Tar	0.5	0.8	3.5	3.5	n.a.	n.a.	0.2	0.5
Majh, Tar	0.8	3.0	2.5	5.0	5.0	15.0	0.5	1.5
Ghatta Muhan	0.3	0.8	0.6	1.3	10.0	10.0	0.5	1.0
Jhankri	0.5	2.0	1.0	2.0	4.5	9.0	0.5	1.0
Chholang	0	4.6	2.0	3.5	63.0	63.0	0	1.5
Siran, Baguwa	2.5	5.5	3.5	8.5	10.0	15.0	0.5	1.5
Majh, Baguwa	0	5.0	0	7.5	0	20.0	0	2.0
Bhanjyang	0.4	0.4	0.5	1.5	3.0	6.0	0.5	0.6
Dhap and Subedar	0.2	0.4	3.0	12.0	6.0	15.0	0.2	0.4
Total	5.9	28.6	16.8	48.3	108.5	170.0	3.7	13.5
Increased area		22.7		31.5		61.5		9.8

*Not available

Table 4. Value of winter crop production due to irrigation as estimated using average yields and farmgate financial prices.

Crop	Increased area[a]	Estimated yield[b]		Value[c]	Value of production increase
	(ha)	Unirrigated (kg/ha)	Irrigated (kg/ha)	(NRs/kg)	(NRs)
Wheat	61.5	700	1200	3.54	109,000
Potato	22.7	d	10,000	2.80	564,000
Oilseed	31.5	300	600	12.35	117,000
Vegetables	9.8	n.a.	n.a.		
Total					790,000

[a]From Table 3.

[b]HMGN Irrigation Master Plan. 1990. Table B1-12

[c]HMGN Irrigation Master Plan. 1990. Table B2-1

[d]Assumes unirrigated millet grown yielding 810 kg/ha at a value of NRs3.90/kg

Source: HMGN Irrigation Master Plan. 1990. Tables B1-12 and B2-1.

CHAPTER 4

Recommendations: A Process for Assisting Existing Systems

BASED UPON THE experience and lessons of the WECS action-research project, it is recommended that assistance to existing systems employ procedures that are distinct from those used for identifying and building new systems. The following activities are proposed as a basis for the new procedures.

In the formulation of the procedures, four lessons are of primary importance.

1. If a system already exists, then farmer initiative has taken place, land and water resources have been identified, and some levels of institutions, experience, and knowledge are available to be tapped.
2. The intention of "assistance" is to stimulate the irrigation users to be involved in making their own improvements (a little assistance is better than too much).
3. Poor maintenance of physical facilities and the inability of farmers to make simple improvements on their own are symptoms of a need to improve management, without which assistance will not be used effectively and the system will not likely operate to its potential.
4. Helping farmers manage the assistance inputs for physical improvements is an effective management training method that strengthens the water users' organization.

The activities that are proposed can be divided into three parts. The first is identification and selection of systems to be assisted. The second is subproject preparation with extensive input from the farmers. And the third is implementation of financial, material, and management inputs.

IDENTIFICATION AND SELECTION OF SYSTEMS

The farmers need to be involved in the process of gathering data for the resource inventory

In order to select the systems that will receive assistance, a systematic irrigation resource inventory that provides basic information about each existing system is needed. This requires a field-based data collection process where each system is visited and the water source, canal, and command area are inspected together with the farmers. This visit should provide oral and written information to farmers in each system about the process they will need to follow to request assistance. This information should list the farmers' responsibilities, such as registration of their users' association and the extent to which they will need to provide labor and other resources.

A computerized database is needed for sorting and ranking systems according to established criteria

Since there will be hundreds, even thousands, of systems in some districts, a computerized database will be essential for processing the information. The database will need to be designed to allow sorting and ranking of systems according to the criteria with which systems are to be selected for assistance. These should at least include water and land-resource availability for expansion, potential for increasing cropping intensity, and maintenance cost reduction potential. The sorting, ranking, and selection of systems should be done on a watershed basis to facilitate supervision of improvements. This process should distinguish among systems where assistance will result in increased agricultural production and those for which it will not. After this level of identification and selection is accomplished, there will be no need for a feasibility analysis except in cases where functionality of systems, if provided only a low level of assistance, is questioned. Instead, ongoing evaluation of the impact of assistance should be used to modify the criteria for selecting systems as the tool for controlling poor investment.

SUBPROJECT PREPARATION

Design of Inputs

A rapid appraisal should be designed to provide information upon which decisions for assistance can be made

After projects are selected in a watershed, the nature and extent of assistance needs must be determined. Rapid-appraisal techniques should be employed to collect information necessary for project preparation and to communicate information about procedures to the farmers again. The rapid appraisal must be designed to collect pertinent data for making all decisions regarding assistance, including the ability of the users' organization to manage the assistance inputs or the training support it requires for all of the following: making decisions, keeping accounts and labor records, establishing working relationships with other systems regarding water rights, and determining water allocation among users. Data upon which decisions regarding possibilities for expanding the users' group and identification of the approximate level of material and financial assistance required for making physical improvements must also be included.

Cost estimates should be made while the rapid-appraisal team is in the field

Management training input can be planned to meet the particular requirements of each users' group. However, determination of the physical-improvement needs is much more difficult. In order to minimize the cost of data collection and design, the rapid-appraisal team should make an on-site estimate of the physical-improvement cost — with a permanent record of the field notes to be kept on file for checking and controlling. At the same time, they should assess the priority of each proposed improvement to establish which are essential for increasing the capacity and reliability of the system, which would reduce maintenance requirements, and which are desirable but could be done by the users.

The responsibilities of the water users' group must be clearly communicated to them orally and in writing

Conditions for proceeding with the subproject should be communicated orally and in writing. One condition should be that the users' group compile and deliver information such as the name of each present and future (if the system is to be expanded) irrigation user and the size of each individual's landholding in the system. Another condition should be the registration of the organization in the appropriate district office, giving legal status to the group for receipt of a grant, loan, and for bank transactions.

Allocation of Resources

Funds should be allocated according to the priority needs and the farmers' resources

A funding limit should be established to assure that the farmer organization can effectively utilize the amount available

When information from all the systems in a watershed is available, an amount equal to the sum of the priority needs — those that are essential for expansion or increased cropping intensity but difficult for farmers to do without assistance — less the amount to be contributed by the beneficiaries, should be granted up to a ceiling of about NRs3,000-5,000/ha (US$136-227/ha). The logic for the limit is that few farmer organizations are capable of mobilizing enough labor in a year to utilize more funding effectively. A larger allocation requires contractors and labor from outside the users' group which should be avoided as far as possible. The ceiling should not be the limit of funds that can be spent in a particular system but rather the limit to be allocated at one time. After assessing the continuing needs and effectiveness with which the first funds were used, additional assistance should be considered up to a limit set to allow equitable distribution of resources.

IMPLEMENTATION

Setting Priorities

The beneficiaries need to be advised of the funds they will be granted so they can set realistic priorities for the work to be done

On the third visit to a system selected for assistance — the inventory was the first visit and rapid appraisal the second — the amount available to the system should be announced along with the conditions and procedures under which it can be used. By announcing a fixed amount, the beneficiaries can help set detailed priorities for implementation. Without a fixed limit, they try to include all possible work hoping to attract more money without being clear about their priorities.

Management Improvement

Strengthening the users' organization is the first assistance activity

If the organization must be strengthened to manage the assistance, that will be the first activity. Farmer-to-farmer training visits, public meetings, and continuous dialogue with a facilitator may be required. The organization must prepare and approve a constitution. This should reflect existing practices and relationships and accommodate the requirements for registration of the users' group. Assisting the users' group in preparing this document, if it does not already have one, will be an important management-training exercise.

The users' organization must agree on water-allocation and resource-mobilization rules and procedures before physical improvements begin

All decisions regarding policies that govern the functioning of the users' group must be made in public meetings after adequate notice is given to all irrigation users to attend them. The practice of keeping written minutes should be encouraged. Discussion and agreement on all the rules, roles, and methods of conflict management are essential before physical improvement work begins.

In particular, there must be prior written agreement on: 1) allocation of water among members of the users' group; 2) options and procedures for accepting new members into the group; and 3) rules for labor, cash, and materials mobilization that will continue as part of the maintenance rules for the system.

Because the construction activity is similar to the maintenance that the users' group will need to continue to perform on its own, functionaries needed for operation and maintenance of the system should be the main factor determining the composition of the committee that is formed to take care of day-to-day management of the assistance. It is important that all irrigation users understand that they elect the functionaries and must hold them accountable for their actions; irrigation users should also be responsible to replace them if they do not perform their duties properly.

Detail-design work needs to be field-based, and agency supervision must be done in the field

Detail-design work should proceed in the field at the same time that rock cutting and materials collection are initiated. If a structure requires design input that cannot be done in the field, the design information can be collected while construction proceeds on the simple sections where design is only a part of laying out the dimensions for a retaining wall or cross drain, etc. Agency supervision for checking and approving designs must be done in the field.

Supervision of Improvements

A field supervisor must be on site and in constant communication with the water users throughout the assistance process

Construction supervision should be intensive and viewed as a training exercise for the farmer organization that improves the farmers' construction skills, enhances their ability to make decisions, improves their ability to supervise labor and use of materials, and demonstrates the need to keep appropriate written records. Whether agency staff or private consultants supervise the physical and management improvements, a field supervisor responsible to the implementing agency must be in continuous contact with the users' group. A third party representing the donor or financing agency should have responsibility

for monitoring the progress of the field work, for helping settle disputes between the users' group and the implementing agency, for auditing the accounts, and for checking expenditures against the measurement book record at the completion of the work.

The measurement book should include an accurate sketch of each structure and the design detail. The quantity of work done and material used can then be recorded in the book with reference to each structure. A photocopy of the measurement book should be returned to the farmers for their record.

The total grant funds should be deposited into an account operated by the joint signatures of persons elected by the water users' group and possibly of an agency accountant

The total grant funds should be deposited into a joint-signatory account in a bank. Depositing the money communicates to the users' group that it is now the group's resource to be used according to its approval, within the rules the agency has for disbursement and accounting. One or several of the elected leaders of the users' group, possibly together with the agency accountant, should jointly sign for releasing funds against a written order that itemizes the expenditure and is signed by authorized users' group members and the site supervisor. The farmers appointed by the users' group should participate with agency staff in selecting and purchasing materials, supplies, and tools for their system.

To assure harmony and promote confidence among the water users, decisions regarding the improvement work should be made by the users' organization in public meetings, and a written record kept

It is recognized that piecework may be more efficient than day labor and may be the desired work mode for many farmers. One of the functions of the users' group must be to set the rates (subject to local or government ceilings), allocate the work to be done, and control the quantity and quality. Equitable allocation of work, both in quantity and in difficulty, is essential if the organization is to work in harmony. Strong input by the supervisor with

discussion and decisions taking place in public meetings where minutes are kept and signed by all participants are important for this. If there is a fixed amount of money available that is less than necessary for all improvements, the users have an incentive for keeping the rates reasonable and controlling the expenditure.

The farmers should have responsibility for finding and hiring skilled labor

In many cases, skilled labor such as masons, rock cutters, and wire-gabion weavers is not available in the users' group. Transferring technology and skills through participation in the improvement is an important goal for improving the sustainability of these systems. The farmers should be given responsibility to assist in finding and hiring skilled manpower since it is their money that is now being used for the payments and to prepare them for the time when they will need to draw on such skills for emergency repairs. Contracts for transportation and commodities that could save money should be given only if there is approval by the users' group. Control of these contracts should be vested jointly with the users' group and the supervisor.

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