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FARMER-MANAGED IRRIGATION SYSTEMS IN NEPAL

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28.1 INTRODUCTION

In most places in the hills of Nepal, and to a somewhat lesser extent in the Tarai, the low elevation plains of southern Nepal, wherever the potential for irrigation exists, farmers have already made efforts to irrigate at least part of the potential command area. The command area is defined as the cultivable area that could be irrigated by a given canal if there were sufficient water available. Estimates suggest that farmer-operated irrigation systems provide 93% of the irrigation in the hills and 74% in the Tarai (Water and Energy Commission, 1981).

Some irrigation systems were built hundreds of years ago under the direction of local rulers. Other systems, including some recent ones, have been developed entirely by local farmers' initiative and resources. The size of farmer-managed irrigations systems is normally determined by the hydraulic boundaries of an individual diversion and canal. Systems in the hills vary from several hectares to about 100 ha, the size being constrained largely by topography. In the Tarai, farmer-managed systems of more than 5000 ha have been observed (Pradhan et al., 1988). The term "farmer-managed" in refers to irrigation systems operated by the irrigators with little or no input from the government or other outside agencies. This type of irrigation system is also referred to as community-managed irrigation, peoples' irrigation, communal irrigation, and simple irrigation.

The description of farmer-managed irrigation presented in this case study is based primarily on a 1982-83 study conducted by the authors on 25 systems in the hill area of the Western and Far Western Development Regions of Nepal. In eight of the systems, intensive field measurements, farmer interviews, examination of the organizations' records, and participation in meetings of the organizations were carried out over a period of one and a half years. Information concerning the remainder of the systems was obtained through rapid appraisals conducted by a team, including the authors. These systems were well-organized and managed, making possible intensive agricultural

production. More recent work undertaken in Nepal's Central Development Region by the Water and Energy Commission Secretariat of the Ministry of Water Resources with the assistance of the International Irrigation Management Institute has revealed farmer-managed irrigation systems with less sophisticated management organizations and less intensive agricultural production than those reported here.

28.2 ORGANIZATION

Wherever there is existing irrigation, there is also an organization to carry out the primary tasks of an irrigation system: construction of the civil works, allocation of water entitlements, water distribution, maintenance, and management of conflicts arising among members. To carry out most of these tasks, the organization must have a means of mobilizing both human and financial resources.

A broad diversity of organizations and means to carry out these irrigation system tasks have been developed among farmer-managed systems in Nepal. Some farmer irrigation organizations are informal, while others exhibit a high degree of formality with scheduled meetings, designated functionaries, written rules, accounts, lists of members and their water allocation, and a register of members' attendance at work. In the hills of Nepal, the amount of organization required and the formality of the organization is, to a large degree, a function of how much labor must be mobilized to maintain the system to capture and deliver the available supply of water as needed. If little labor is required, the organization tends to be much less formal and vice versa.

Even though there are frequently a series of canals–which may even cross each other–delivering water from the same stream to a contiguous area, each canal has a separate organization for its operation. A given plot of land within the command area usually has water allocated to it from only one canal. All farm operators receiving water from a given canal are usually considered members of the organization that operates that canal system. A farmer is a member of several irrigation organizations if he cultivates several plots of land which receive water from different canals.

Nearly all of the irrigation organizations have some recognized functionaries. They are usually selected at a meeting of all the members. Typically one functionary is responsible for organizing and supervising work on the system, and another keeps the accounts, minutes of the organization's meetings, and a record of members' attendance at work. Depending on the nature of the system, other functionaries may be appointed. In larger systems there may be several tiers or levels of organization with officers selected to represent different areas of the system at different levels. The performance of these functionaries is usually reviewed annually, and they may continue or be replaced depending on members' satisfaction with their performance. While functionaries may be responsible for specific tasks, major decisions are made only at meetings of all the members.

28.3 IRRIGATION TASKS

28.3.1 Construction

Groups of farmers have worked hard to develop their water resources, investing large amounts of their labor and, in some cases, cash. Some have constructed long canals through jungle, hard rock, and along the face of cliffs. Often they have hired workers from other villages who are skilled in cutting canals and tunnels through hard rock. Until very recently all materials used were from the local community, though now cement, steel, and plastic pipe brought from outside have become quite common. Flows in excess of 300 liters per second have been measured in canals constructed by farmers in the hills, and flows of over ten cubic meters per second have been observed in systems in the Tarai.

28.3.2 Water Allocation

An irrigation system must somehow allocate entitlement or rights to the water among the farmers. This is typically based on either of two basic principles. The most common principle used is to divide the water in proportion to the area of land irrigated by each farmer in the command area. Thus, if a farmer cultivates one-twentieth of the irrigated land area, he is entitled to one-twentieth of the water in the system.

The other approach to water allocation is to sell shares in the system to the members. There is no relationship between land ownership and water ownership in this method of water allocation. In one system the total water supply is divided into 60 shares, and the 105 members each own from one-eighth of a share to four shares. If one farmer has more water than he needs for his land and another has less than desired, the one can sell water to the other. One year, ten additional shares were added to this system and sold for a total of Rs 28,000 (about $2,000 U.S.). The money was used to make improvements to the main canal so that more water could be delivered to serve a larger area. It is important to note that this principle of water allocation by purchased shares offers both an incentive for efficient use of water and a mechanism for expanding the area irrigated.

28.3.4 System Operation

Water Distribution. In a well-functioning irrigation system, water is distributed to farmers' fields in the amount to which each is entitled by the allocation scheme. Three methods of distributing the water for monsoon rice cultivation have been observed.

One method in the systems studied is through the use of proportioning weirs called *saachos*. A *saacho* is made from a log with two or more notches of equal depth but varying widths cut into the top. It is installed in the canal so that all the water flows through the notches, causing the flow to be divided in the same proportions as the ratio of the widths of the notches. In some systems these *saachos* are used only to divert a portion of the flow from the main into secondary canals, while in others they are used right down to the individual field level.

Another common method for distributing the water according to the allocation is by a timed rotation. Each farmer takes water from the canal for a specified length of time. The length of each farmer's turn is calculated to provide him the proportion of the flow to which he is entitled by the allocation. In some systems in the Far West of Nepal intermediate storage tanks are used to collect very small flows. The tank is then emptied by periodically opening the outlet and allowing a high discharge to surge down the canal to individual plots.

The third method of distribution observed is by contract. Here the members of the organization pay one or more persons to deliver the water to all the fields. The contractors adjust the flow throughout the command area so that all fields are covered as adequately as possible. This method of distribution is especially suitable when the fields are a long distance from the village where most of the farmers live.

Water distribution for *wheat and maize* tends to be much less precisely regulated. Usually the farmers decide among themselves when each will irrigate his fields, and then each farmer will be allowed to take water until his fields are fully irrigated. Since water is relatively scarce at the time of maize planting, an appointed functionary of the organization may be in charge of distributing water so that all members are able to plant at least some of their maize at the optimal time.

Maintenance. The critical period for maintenance of most farmer-managed irrigation systems is prior to and during the monsoon season. Most organizations have a meeting of the members in May where plans are made for the major annual maintenance which is done prior to land preparation for rice planting.

Generally, the maintenance is done by the members, and they contribute labor in proportion to the benefits they receive from irrigation. Some organizations give a contract to one or more members for this work, and all members contribute money to pay the contractor. Cash may also be raised in this way to purchase tools and cement.

An important element in the operation of a hill irrigation system is a method for early detection of any problems at the intake, landslides that block the canal, and leaks in the canal. During the monsoon, usually two people patrol the canal every day. The members may do this turn by turn, or two people may be hired to do this on contract. The persons patrolling the canal do minor repairs and alert the rest of the members if more labor is required. If they report an emergency, the leader will call all members to report immediately for work. Work may be carried out continuously night and day until water flows again.

Conflict Management. Irrigation organizations inevitably experience conflict. After all, they distribute a limited resource among many members requiring their cooperation for operation and maintenance. Some members may try to steal more than their allotted share of the water, or may fail to contribute their required share of the labor and cash to maintain the system. To function well, irrigation organizations must have an effective way of managing conflicts when they arise.

Persons who are caught stealing water are usually fined, may be physically punished, and frequently are denied water in their next turn. One organization exacted a public confession from a member caught stealing water, and recorded it in the organization's minute book. Most organizations levy cash fines against members who are absent from work. Since the enforcement of sanctions is in the hands of the members who benefit from the proper adherence to the rules and who control the distribution of water, they have both the incentives and the means to enforce the rules.

28.3.5 Extension and Improvement of Systems

In all of the farmer-managed irrigation systems we have observed, the organizations have, over time, improved the canals and expanded the area and number of farmers served. Most improvements have been accomplished by mobilizing resources from the members. Money has been raised to pay persons especially skilled at cutting canals and tunnels through rock, and to purchase cement. Recently, irrigation organizations have been turning more to government resources for the improvement of systems, and over half of the observed systems have received some assistance from the government. Sources of government assistance have been the Irrigation Department, Ministry of Panchayat and Local Development, and the district panchayats. Nepal's government structure until 1990 was made up of elected "panchayats" or governing councils at different levels. The smallest or local unit of government is the Village Panchayat, of which there are more that 3,000. There are 75 District Panchayats.

When applying for and receiving government assistance, the local irrigation organization gives up some control over what work is done and how it is carried out. In some cases it appears that the organization's efforts are becoming increasingly focused on pursuing external resources. "Grantsmanship", i.e., efforts to secure government grants, is occupying more of the organization's efforts than "self-help", i.e., the mobilization of resources from within the organization.

28.3.6 Resource Mobilization

An irrigation organization must be able to command labor and material to accomplish the irrigation system tasks described above. The ability to mobilize resources in a timely fashion is the major factor distinguishing a well-operating irrigation system from an ineffective one.

In systems where water is allocated in proportion to the area irrigated, members are usually required to contribute labor and cash according to their land area served. For instance, in one system a person with 0.5 ha of irrigated land is required to provide one laborer every day that routine maintenance work is done. A person with only 0.25 ha has to supply one laborer every other day. In another system, cash was raised at the rate of Rs 160 ($8.89 U.S.) per hectare to pay a contractor to do the maintenance.

Farmer irrigation organizations which allocate water in proportion to purchased shares of water also mobilize labor and cash contributions on this

basis. One laborer must be provided each day of routine maintenance for each share of water owned. Several years ago, one organization with 105 members irrigating 34 ha, raised cash at the rate of Rs 250 (about $18.00 U.S.) per share for a total of Rs 15,000 ($1080 U.S.) from 60 shares to improve their canal. This cash was in addition to their regular maintenance expense.

Another basis for resource mobilization is in proportion to the productivity of the irrigated land. In one case, each member's irrigated land is rated by measuring the yield of rice. A volume measure approximately equal to 50 kg of unhusked rice is used. Both labor and cash are contributed in proportion to the number of volume units each person's land yields.

When emergency maintenance is necessary, most organizations require all members to work, irrespective of the number of shares owned or the size of the land holding irrigated. At times, work will continue at night by the light of kerosene lanterns and flashlights.

The resources farmer irrigation organizations mobilize are significant. Several systems with command areas of 30 to 50 ha regularly mobilize more than 2000 man-days of labor in a year. One organization with 55 members raised Rs 70,000 (about $5,000 U.S.) in one month's time to install a pipe to bring additional water from a source across a major river.

To mobilize these resources, an irrigation organization must have means of enforcing its rules and assessments. Most organizations keep written records of members' attendance at work, and people are fined if they do not work as required. Fines are set at about the same level as the local daily wage rate. If a person refuses to work or pay the fine, the organization can deny that person water. Several organizations have reported that when a member has refused to pay, a group of the members has gone to that person's house, taken his pots and pans and threatened to sell them. The person then paid the fine, and all the members observed how serious the organization was about enforcing the rules.

28.4 EVALUATION OF PERFORMANCE

Farmer irrigation organizations have successfully mobilized substantial resources to construct and operate their systems. This in itself is a major accomplishment. However, evaluation of farmer-managed systems should ultimately be based on the agricultural productivity achieved by the irrigation.

In most of the systems observed, triple-cropping is practiced with cropping intensities of nearly 300%. Average yields from sample crop cuts in four mid-hill systems ranged from 3.0 to 3.5 metric tons/ha for rice and 2.0 to 2.5 tons for wheat. Maize yields are similar to those for wheat, resulting in approximately eight tons of grain production per hectare per year. Given the infrequent use of management-responsive varieties and fertilizer, these figures are quite remarkable, and demonstrate the effectiveness of these systems.

28.5 LESSONS FROM FARMER-MANAGED IRRIGATION SYSTEMS

Several important lessons emerge from the study of farmer-managed irrigation systems in Nepal. These points, which have important implications for irrigation development, are summarized below:

1. In most locations where the potential exists, farmers have already developed the water and land resources to some extent. Thus, local experience with water management and irrigated agriculture already exists. Wherever farmers must work together to bring water to their fields some degree of organization has developed. This existing organization should provide the starting point for a users' group, and farmer knowledge and experience should be tapped whenever government provides assistance to an irrigation system or plans new irrigation development in the area.
2. Farmer-managed irrigation systems are effective in managing the water resources to achieve improved agricultural production. The organizations are capable of: a) timely delivery of water; b) allocation and distribution of the water; c) labor mobilization for maintenance of the system; d) raising cash to pay for maintenance of the system; e) supervising and carrying out construction; and f) identifying the most serious problems in the physical structure and setting priorities concerning what should be improved first.
3. Farmers use an incremental approach in irrigation development. This allows the accumulated knowledge and experience of each undertaking to be utilized in the next improvement or expansion. By undertaking one segment at a time, there is minimum disturbance of the existing irrigation supply and work can be fitted to slack periods in the cropping cycle when labor is available.
4. The principle upon which water allocation is based can influence the efficiency of irrigation management and the expansion of the area irrigated. Water allocation by purchased shares provides financial incentives while allocation in proportion to area irrigated provides no such incentives.
5. "Ownership" of the system greatly affects farmers' attitudes and behavior. The users "own" the farmer-managed systems, and they take full responsibility for its operation. The performance of the system is a direct result of their efforts, and they provide the resources--labor and cash--to operate it effectively. The farmers in these systems have both the incentive and means to enforce compliance with the rules formulated for efficient and equitable operation of the system.

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