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Increasing Agricultural Production in Nepal: Role of Low-cost Irrigation Development Through Farmer Participation

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INTERNATIONAL IRRIGATION MANAGEMENT INSTITUTE

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Summary: Nepal irrigation policy directives and resources must be channeled to encourage the participation of beneficiaries and to focus the functions of the Department of Irrigation on a management perspective. Nepal needs to develop an alternative strategy and lower-cost approaches for increased agricultural production. The lower-cost approaches recommended in the paper include: 1) incorporating farmer participation in operation and management, 2) considering lower cost structures in surface irrigation and underground water development, and 3) improving the management of irrigation systems.

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Preface

THIS PAPER WAS prepared upon the request of the National Planning Commission for presentation at a one-day seminar on "Irrigation for the Fulfillment of Basic Needs by the Year 2000." The seminar was chaired by the Assistant Minister of Water Resources. The Vice-chairman and members of the Commission, members of the National Panchayat responsible for monitoring the Basic Needs program, and His Majesty's Government of Nepal departmental heads participated in the seminar. The paper presented here includes revisions incorporating the valuable comments contributed by participants of the seminar.

I would like to extend my sincere thanks to the National Planning Commission for giving me the opportunity to present this paper.

I acknowledge the valuable comments given by Dr. Robert Yoder, IIMI/Nepal, and the assistance given by Mr. Naresh Pradhan in preparing the tables for presentation in this paper. Last but not least, I acknowledge the help given by Mrs. Juanita Thurston in editing this paper.

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Executive Summary

IF THE IRRIGATION sector in Nepal is to achieve its target growth and then sustain the operation and management of the expanded irrigated area, policy directives and resources must be channelled to encourage the participation of beneficiaries and to focus the Department of Irrigation on a management perspective.

Investment resources for the irrigation sector are decreasing everywhere in the world. Nepal will not be the exception. To fulfill its basic needs in the years ahead, Nepal needs to develop an alternative strategy which incorporates lower cost approaches for achieving increased agricultural production. The nation needs to harness its water resources using its own resources. This requires a new strategy for resource mobilization from within the country and from external assistance in the form of loans and grants.

Low-cost approaches recommended in this paper include: 1) incorporating farmer participation in operation and management, 2) considering lower-cost structures in surface irrigation and underground water development, and 3) improving the management of irrigation systems. The key element in these alternative lower-cost strategies is integrating the participation of the farmers at every stage in the process, from needs assessment to design to O&M.

To achieve greater farmer participation, a collaborative agency approach is necessary. The farmers need to develop a sense of ownership over their irrigation systems. They must be convinced that by taking more control over

their systems, they can obtain a more reliable water supply and thereby increase their productivity and, ultimately, the benefits to their households.

PRACHANDA PRADHAN
May 1988

CHAPTER 1

Overview of Irrigation Development

Introduction

THIS PAPER ATTEMPTS to analyze the role of irrigation in agriculture from the perspective of 1) national targets set in the sector strategy, 2) cost recovery and financing considerations, and 3) improved performance of the systems through farmer participation and management of operation and maintenance (O&M).

There are at least three groups in the irrigation sector: the national policy-making agencies, irrigation agencies, and the users. Each of these groups places different priorities on sector objectives. Policy-making agencies invest public resources in irrigation systems with the aim of achieving increased and stable production at the national level at a reasonable O&M cost. Irrigation agencies place priority on minimizing agency costs and assuring the economic security, stability, and power of the agency. Users value adequate and reliable water delivery to enable them to achieve increased production and thereby increase the household benefits and decrease household costs (Uphoff et al., 1988:5-6).

The objectives of irrigation development in Nepal from the planning commission perspective are: 1) to achieve increased agricultural production through investment in the irrigation sector, 2) to recover the cost of the investment and have O&M costs borne by the users, and 3) to promote the active participation of the farmers in the management of the systems.

In 1985, His Majesty's Government of Nepal adopted a policy to fulfill the nation's basic needs by the year 2000. One effect of this policy has been to further enhance the role of irrigation in achieving higher agricultural productivity. Consequently, the National Planning Commission has been investigating the nation's resource base to determine what further investments are necessary to fulfill this objective.

A ncte of caution is required here: the development of the water resources of a nation is a long-term policy and program, requiring careful consideration being given to implications extending beyond the year 2000. It is believed that investment in rehabilitation and small irrigation systems with short gestation periods will bring positive results. Improvements in the management of the present systems have also been shown to increase the efficiency of the system and, thus, to increase agricultural productivity. Recently, most of the loans in the irrigation sector have revolved around these concepts. However, the large-scale and long-gestation period required for water development projects must not be ignored. Long-term and short-term goals need to be spelled out so that one is not sacrificed for the sake of the other.

Context

Water is one of the primary resources of Nepal. People have been utilizing the water resources in agriculture through the construction of irrigations systems for centuries. This tradition gave birth to the farmer-managed irrigation systems (FMIS) scattered all over the country. Today, these systems produce about 50 percent of all rice grown in the country.

The government did not play an important role in irrigation development until recently. The first public sector irrigation system, "Chandra Nahar," was constructed in 1923. Before this period, there were a few "Raj Kulos"[1] having state patronage. In the 17th century, King Ram Saha issued an edit that irrigation and its management were the responsibility of the the community and conflicts relating to irrigation were to be resolved by the community.

Nepal's First Five-Year Plan (1956-61) did not even recognize the existence of FMIS. Their existence in the Nepalese economy was noted only in 1981 (Water and Energy Commission Secretariat, 1981:36-43). The government now realizes farmer-managed irrigation systems are important resources for the agricultural development of Nepal.

Nepal's irrigation systems can be broadly categorized into two types based upon management responsibility: farmer-managed systems and agency-managed systems. In FMIS, farmers take the responsibility for water acquisition, water allocation and distribution, and the overall management of the system on a continuous basis. Any external assistance to farmer-managed systems is

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[1]Irrigation systems constructed under the patronage of the king or the State.

occasional as specific needs arise. In agency-managed systems, government personnel are responsible for the management of the system with varying levels of farmer participation. While the farmers may be responsible for aspects of O&M, (as in jointly managed systems), government assistance and presence are ongoing.

Approximately 350,000 hectares (ha) are under agency management whereas 608,000 ha are managed by the farmers. The Agricultural Development Bank of Nepal has developed about 106,000 ha.[2] Although there has not been agreement on the extent of area under farmer-managed irrigation, it can safely be concluded that a greater area is under farmer management. An estimated 1,700 FMIS exist in the Tarai and over 15,000 exist in the hills of Nepal.

The total cultivated area in Nepal is estimated to be 3.1 million ha. The irrigable area is 1.9 million ha. Out of this area, 1.6 million ha are in the Tarai and 0.3 million ha in the hills. If we combine the farmer-managed systems and agency-managed systems, the total area under irrigation comes to 1,058,000 ha, suggesting about 33 percent of Nepal's cultivable land to be under irrigation. Thirty-three percent of this total area is presently agency-managed and 67 percent farmer-managed. It is estimated that 350,000 ha, or only one-third of the irrigated area, have perennial irrigation. Others have facilities lasting only one season.

Agricultural Productivity Targets

When His Majesty's Government of Nepal adopted the basis needs policy, two important interrelated targets were set: wheat production was to be increased from 1.25 metric tons (mt)/ha to 2.5 mt/ha and rice from 2 mt/ha to 3.5 mt/ha. The total production per year was targeted for 6 mt/ha, almost double the present production level. However, production trends during the late sixties and seventies are not encouraging. Not until the mid-eighties has there been some improvement in rice production (Table 1).

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[2]The Water and Energy Commission Secretariat Water Resource Inventory of *Tarai* District reports the existence of 458,000 ha of FMIS in the *Tarai*. It is estimated that in the hills of Nepal there are more than 150,000 ha of FMIS. The Agricultural Development Bank of Nepal has thus fer developed 106,000 ha employing different forms of irrigation technology (Gorkhapatra. 29 September 1988:1).

Table 1. Average yield of major crops in metric tons per hectare (mt/ha) during the 1960s-1980s.

Crop	1961/62-1970/71 (mt/ha)	1971/72-1980/81 (mt/ha)	1986/87 (mt/ha)
Rice	1.92	1.88	2.03
Wheat	1.20	1.14	1.24
Maize	1.89	1.69	1.33

Source: Department of Food and Agricultural Marketing Services, 1988.

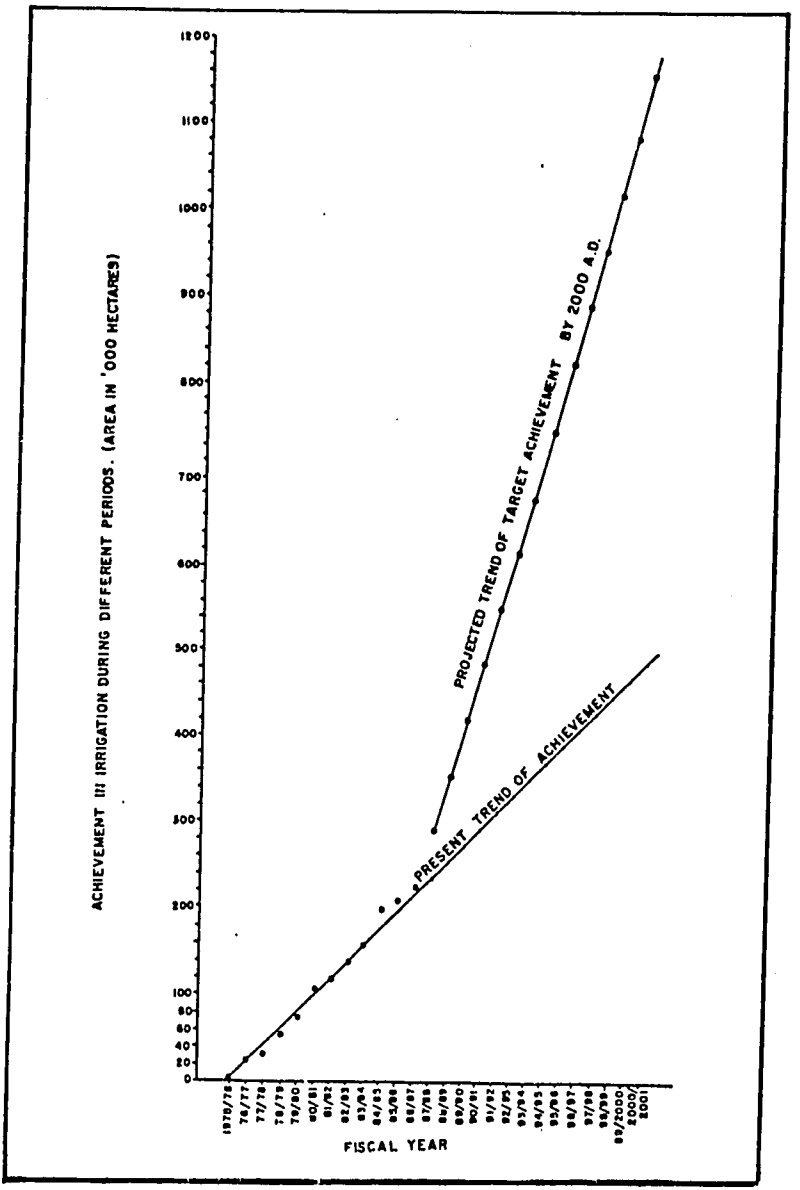
Looking at productivity by district, 69 districts produce about two metric tons of rice per hectare. Table 2 ranks districts by rice production, and Table 2a describes the area, production, and yield of principal food grains. Only six districts have higher production; Kathmandu, Bhaktapur, and Lalitpur top the list, producing between 4-5 mt/ha. There are reasons for this: the Kathmandu valley has access to more agricultural inputs and markets, extensive irrigation facilities, and productive soil. The higher productivity of the Kathmandu valley reenforces the observation that irrigation alone is not sufficient to increase productivity; irrigation is a contributing factor, provided other factors are also available.

Increase in the area brought under cultivation was the primary way by which productivity was increased.

Another important target in the effort to achieve the fulfillment of basic needs is to bring an additional 853,835 ha under irrigation. The World Bank estimates to maintain the present rate of food consumption; Nepal needs to bring an additional 35,000 ha under irrigation each year just to keep up with population growth.

The target of providing irrigation facilities to an additional 853,835 ha by the end of this century means an additional 65,679 ha must be brought under irrigation each year. (See Figure 1 showing the trend of achievement in irrigation.)

Figure 1. Trend of achievement in irrigation.



Source: HMG, Ministry of Finance. Economic Survey of Nepal 1987/88. Kathmandu, 1988 p.8

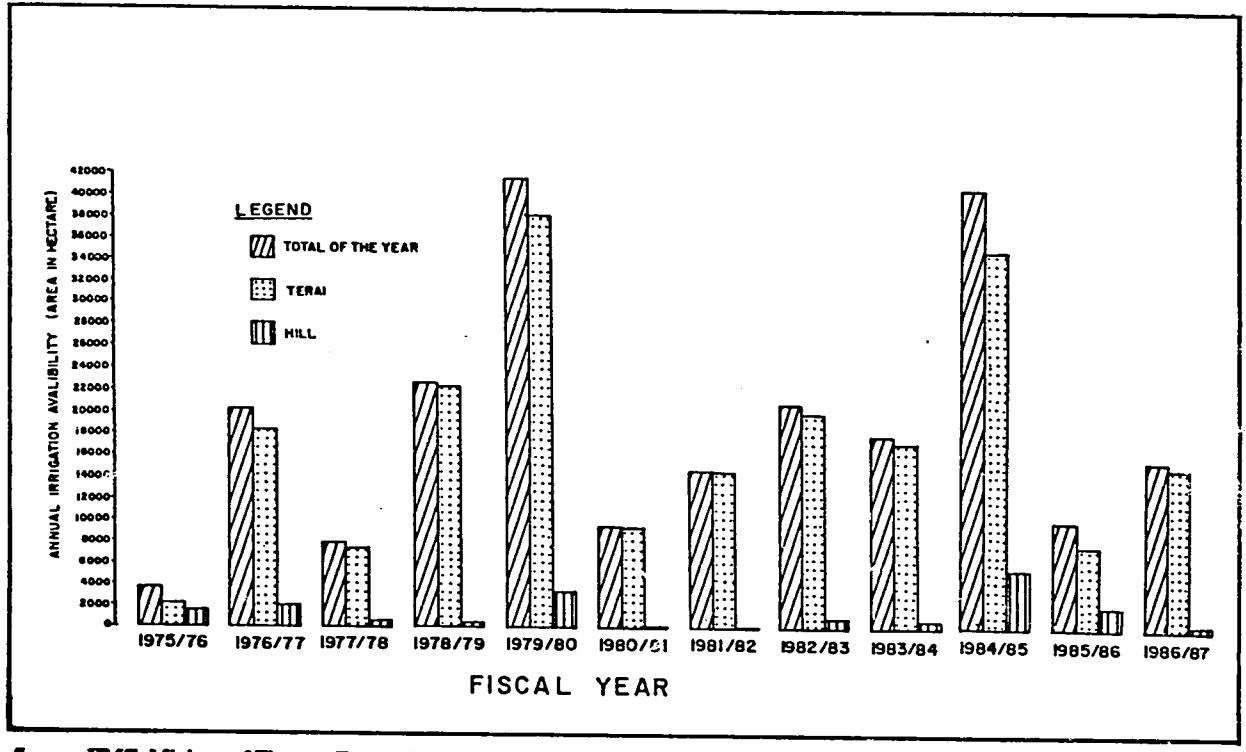
Table 2. Ranking of districts by rice production in 1987/88.

Number of Districts	Range of mt/ha	Districts with high rice yields	Area (ha)
46	Less than 2 mt/ha	-	-
21	2-2.50 mt/ha	-	-
1	2.50-3 mt/ha	Parsa	46,320
2	3-4 mt/ha	Chitwant, Bara	28,500 + 56,980
3	4-5 mt/ha	Kathmandu, Bhaktapur, Lalitpur	10,460 + 5190 + 4590
2	No rice production	(Manang & Mustang)	-
Total	-->	-->	152,040
			10.37%

Source: Department of Food and Agricultural Marketing Services, 1988.

The major agency in irrigation development is the Department of Irrigation. Performance during the past 30 years indicates the Department has developed irrigation facilities for an additional 10,000 ha each year. According to their reports, the Department brought an average of 18,000 new hectares per year under irrigation between the years 1975-87. (See Figure 2, Annual achievement of irrigation in Nepal.) To meet the target objective of irrigating 65,679 additional hectares each year will require first, that the irrigation agencies receive substantial support, and, second, that appropriate policies and mechanisms to mobilize the people's participation and resources be implemented.

Figure 2. Annual achievement of irrigation in Nepal.



Source: HMG, Ministry of Finance. Economic Survey of Nepal 1987/88. Kathmandu, 1988 p.8

Table 2a. Area, production, and yield of principal food grains.

Food grain	Year	Area (ha)	Production (mt)	Yield mt/ha
Rice	1984/85	1,376,860	1,709,430	1.97
	1987/88	1,465,640	2,981,780	2.03
Maize	1984/85	578,720	819,150	1.42
	1987/88	673,810	901,500	1.34
Wheat	1984/85	449,960	519,960	1.16
	1987/88	596,640	744,090	1.25
Millet	1984/85	134,370	124,430	0.93
	1987/88	164,770	150,130	0.91

Source: Department of Food and Agricultural Marketing Services, 1988; and the Ministry of Finance, His Majesty's Government of Nepal, 1985.

The Sectoral Lending Strategy paper prepared by the Department of Irrigation cites the goal of developing irrigation facilities for 463,985 more hectares through sectoral lending by the end of the century (Department of Irrigation, 1988: Table 3), of which 99,000 ha of existing FMIS will receive improvements. The Agricultural Development Bank of Nepal is assigned the responsibility of developing 226,950 ha through shallow tube wells and community irrigation schemes. The remaining 138,035 ha will be developed through implementation of large irrigation schemes.

Under a recent reorganization of the irrigation-related agencies, major responsibility for irrigation development activities has been given to the Department of Irrigation. The Agricultural Development Bank of Nepal engages in promoting irrigation facilities in the private sector through loans.

About 25 percent of the irrigation sector's total target for the next 12 years will be undertaken by this agency.

Table 3. Irrigation development targets for the sector lending program.

Region	7th Five-Year Plan (1985 - 1990) (ha)	8th Five-Year Plan (1991 - 1995) (ha)	9th Five-Year Plan (1995 - 2000) (ha)	Total
Eastern	28,935	54,000	27,000	109,935
Central	20,940	34,400	32,000	87,340
Western	24,065	50,100	37,000	111,165
Mid-Western	11,700	35,000	25,100	1,800
Far Western	22,245	36,000	25,500	83,745
Total	107,885	209,500	146,600	463,985

Source: Department of Irrigation, 1988.

CHAPTER 2

Potential for Irrigation Development in Nepal

Surface Irrigation

SURFACE IRIGATION DOMINATES in Nepal. Both agency- and farmer-managed irrigation systems are surface irrigation systems. Appendix I gives details of the productivity of irrigation systems in Nepal.

In the sectoral program, the rehabilitation of farmer-managed irrigation systems is also identified as a potential area for investment that may provide a quick return. However, several questions need to be answered before embarking on a large-scale rehabilitation scheme for FMIS. Some of the questions are: 1) what should be the objectives, 2) how can rehabilitation be best achieved, 3) who can do it best, 4) how would the farmers be involved, and 5) what factors inhibit farmer participation. Some of these questions will be reexamined in the later section on institutional development.

Groundwater Utilization for Irrigation

There have been several studies on the potential for groundwater development for irrigation in the Tarai regions in Nepal.

Shallow tube wells and deep tube wells operate in the Tarai regions. By 1986, the Agricultural Development Bank of Nepal and other agencies had installed over 14,000 shallow tube well units in the Tarai. About 17,000 ha receive irrigation water from deep tube wells in the Tarai. The total potential of groundwater for irrigation has yet to be fully explored.

The Agricultural Development Bank of Nepal plans to install 74,000 units of shallow tube wells in the Tarai by the year 2000. The Groundwater Development

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Board is also exploring the possibility of expanding deep tube wells and conjunctive use of groundwater (World Bank, 1987:8-32).

The same study suggests that the per hectare cost for developing shallow tube wells is between Rs 4,000-6,000 (US$200-300) and the per hectare cost of deep tube wells is approximately Rs 21,000 (US$1,050) at 1986 prices.

The potential for increased groundwater irrigation needs further exploration. Groundwater use provides services quicker, promotes the participation of the beneficiaries in cost-sharing and management, and has tremendous potential for improving cropping intensity, agricultural productivity, and expansion of irrigated area.

Current government policy gives priority in irrigation development to low-cost projects of short gestation period that do not create a heavy recurrent cost burden. In this context, World Bank reports indicate that the most attractive option is offered by shallow rube well development by the private sector with support from an institutional credit system. In this program, small farmer ownership of the facilities has to be encouraged. However, deep tube well systems would be jointly managed by the agency and the beneficiaries. A higher subsidy level may be required to encourage investment by small farmer groups. Compared with capital investments in all public sector irrigation development which are wholly subsidized, these subsidies would be very small on a unit area basis (World Bank, 1987:44-45).

Cost Recovery Issue

Cost recovery is an important issue in financing irrigation systems. Most irrigation systems are financed through loans to be paid over a period of time. There are two types of cost recovery: direct and indirect. Direct cost recovery collects the charges or taxes directly from the beneficiaries. Costs may be indirectly recovered through a land development tax or increases in land revenues. In Nepal, cost recovery has been considered only during the time of loan negotiation when donor agencies express their concern for recovering the costs of the investment. The financing of irrigation development in Nepal has been basically from external resources through loans as compared to grants (Table 4). Since dependency on external resources is high, Nepal must develop a policy which will enable it to recover the costs of expenditures in the irrigation sector so loans can be repaid.

Table 4. Foreign aid in the irrigation sector in Nepal (in million rupees).

Fiscal year	Grant	Loan	Total amount	Grant percentage	Loan percentage
1975/76	1.3	22.7	24.0	5.4	94.6
1976/77	7.5	28.7	36.2	20.7	79.3
1977/78	16.9	29.3	46.2	36.6	63.4
1978/79	46.9	75.0	121.9	38.5	61.5
1979/80	54.3	78.7	133.0	40.8	59.2
1980/81	41.9	106.8	148.7	28.2	71.8
1981/82	54.2	146.5	200.7	27.0	73.0
1982/83	133.7	134.2	267.9	49.9	50.1
1983/84	87.9	249.6	337.5	26.04	73.96
1984/85	154.8	294.4	449.2	34.5	65.5
1985/86	103.3	473.9	577.2	17.89	82.11
1986/87	59.7	455.0	514.7	11.6	84.4
Total	762.4	2094.8	2857.2	26.68	73.32

aUS$1.00 = Rs 24.00 in 1988.

Source: Ministry of Finance, His Majesty's Government of Nepal, 1987/88:62-63.

Water fees are fixed but the collection rate is very low. In some cases, the collection cost is higher than the actual fees collected (Pradhan, 1985:71-77). Even the O&M of the completed systems are subsidized by the government. It has been proposed to collect at least the O&M contribution from beneficiaries. This requires institutional rearrangements to transfer O&M responsibilities to the farmers.

The cost recovery issue is concerned with the cost of development of the system. The per hectare cost requirement for irrigation development varies, depending upon the agencies involved and the type of irrigation system developed. The Department of Irrigation in the Sectoral Lending Strategy paper suggests a cost of Rs 50,000/ha for medium and minor irrigation

development, and Rs 5,000/ha for the rehabilitation of farmer-managed irrigation systems.

In the irrigation sectoral program, the Asian Development Bank took responsibility for irrigation development in the central and eastern regions of Nepal where it estimated a cost/ha of Rs 30,000 for the Tarai and Rs 60,000 for hill systems.

The experiences of the Agricultural Development Bank of Nepal and the Farm Irrigation and Water Utilization Division in gravity irrigation systems indicate that with the farmers' participation, irrigation systems have been developed at a cost of around Rs 5,000-15,000/ha (US$250-750, at the 1986 exchange rate).

The cost aspect becomes an important issue when one talks about the enormous area to be developed in 13 years. Will the very high cost/ha encourage the farmers in general to participate in irrigation development? Will the government be able to pay the cost of expensive irrigation development? Examples from other countries have indicated that giving the farmers loans for irrigation development and promoting their participation for the design and construction of irrigation facilities have tremendously reduced the cost/ha of irrigation construction. This lower cost method for increasing irrigation facilities should be considered by Nepal.

The cost recovery issue raises a number of questions needing resolution. What kind of development is expected? How much infrastructure is necessary per hectare? How can the investment on high-cost structures be balanced with the reliability of water in the system?

Table 5 reports the funding requirements designated in the Sector Loan Plan by scheme. The Sector Lending Strategy paper defines small-scale projects as irrigation systems of 50 ha or less in the hills and 500 ha or less in the Tarai. Medium-size projects include systems of 50-510 ha in the hills and 500-6,000 ha in the Tarai. Projects covering hill systems over 510 ha and Tarai systems larger than 6,000 ha are defined as large scale (Department of Irrigation, 1988).

Table 5. Funding requirements under the Sector Loan Plan, by scheme (in million rupees).

Scheme	Seventh Plan (1985-1990) New area to irrigate (ha)	Cost	Eighth Plan (1990-1995) New area to irrigate (ha)	Cost	Ninth Plan (1995-2000) New area to irrigate (ha)	Cost
Minor and medium irrigation schemes	71,175	3558.75 (Rs 50,000 per ha)	1,23,500	6,175 (Rs 50,000 per ha)	84,600	4,230 (Rs 50,000 per ha)
Improvement of FMIS	24,000 (Rs 50,000 per ha)	120.00	50,000	250 (Rs 50,000 per ha)	25,000	125 (Rs 5,000 per ha)
Groundwater						
(I) STWs	10,000 (Rs 9,000 per ha)	90.00	26,000 (Rs 9,000 per ha)	234	27,000	243 (Rs 9,000 per ha)
(II) DTWs	2,710 (Rs 25,000 per ha)	67.75	10,000 (Rs 25,000 per ha)	250	10,000	250 (Rs 25,000 per ha)
Total	107,885	3,836.50	209,500	6,909	146,600	4,848

Notes:
STWs = shallow tube wells
DTWs = deep tube wells [a]US$1.00 = Rs 24.00 in 1988.
Source: Department of Irrigation, 1988.

To increase production through irrigation, FMIS must be considered as a valuable resource upon which the nation can capitalize. Many FMIS could increase their production if provided with appropriate assistance for structural or managerial improvements. However, farmer-managed irrigation systems

have a tradition of mobilizing resources from within their communities. The resource mobilization methods of these systems need to be better understood before undertaking a rehabilitation assistance program. An appropriate assistance strategy that provides external support as needed but which encourages the farmers to continue to manage their systems should be formulated. (For a description of resource mobilization in FMIS see Appendix II.)

Choice of Projects

The emphasis on small- and medium-scale irrigation systems is on immediate returns on investments. Water resource development needs to be considered from a long-term perspective. The choice of projects should no longer be supply-driven by funding from donor agencies. The Sector Loan Strategy clearly states that the selection of irrigation schemes for assistance must be determined on a demand-driven basis, in accordance with the needs of the country and the beneficiaries. Proposed definitions of project size are given in Appendix III.

Efforts need to be made to mobilize internal resources and to gradually build up the schemes which will serve posterity after 20-30 years. If the country does not proceed along these lines, Nepal will be only a water course for big rivers, with people having no right to use them. The nation needs to harness its water resources using its own resources. This requires a new strategy for resource mobilization from within the country and outside the country.

Looking at resources allocated between the development budget and the regular budget in the irrigation sector, we see that 99 percent of the budget is allocated under development. Table 6 provides the figures for expenditures in irrigation allocated through each of these budgets.

Ninety-nine percent of the government's expenditures in the irrigation sector in the country comes from the development budget. In any plan period, 60-70 percent of the development budget comes from donor funds. Hence, irrigation development and its regular maintenance are heavily dependent on external resources. There is a world trend of decreasing investment in the irrigation sector and Nepal will not be exempted from the effects of this trend. This could have an adverse effect on the whole program of basic need fulfillment of Nepal. Furthermore, few resources have been available for

operation and maintenance of systems as compared to funds available for the creation of new infrastructures. These issues raise the questions of not only how to mobilize external resources, but also how to mobilize internal resources to keep the system productive after construction.

Table 6. General and development expenditures in irrigation in Nepal.

Fiscal year	General expenditure (Millions of rupees[a])	Development expenditure (Millions of rupees)
1974/75	1.8	74.0
1975/76	1.7	98.1
1976/77	2.2	127.4
1977/78	4.3	142.1
1978/79	3.9	226.3
1979/80	2.4	232.7
1980/81	3.2	288.2
1981/82	3.6	359.6
1982/83	4.7	487.4
1983/84	5.1	545.3
1984/85	5.8	652.2
1985/86	6.2	846.7
1986/87	6.9	846.8
Total	51.8	4926.8
Percent	1	99

[a]US$1.00 = Rs 24.00 in 1988.

Source: Ministry of Finance, His Majesty's Government of Nepal, 1988:56-58.

As far as possible, loans should be used to bring presently unirrigated areas under irrigation. Unless Nepal enters into the development of new areas, it will be investing money in areas where irrigation systems already exist. For example, the East Rapti Irrigation Project has several components including the installation of irrigation facilities for about 9,500 ha (Asian Development Bank, 1987). The command area of this project happens to be in the area where there is already a substantial amount of FMIS.[3] Therefore, the net new

[3] About 55 farmer-managed irrigation systems with high productivity and water users organizations functioning were identified within this command area. See Khatri-Chhetri, T.B. et al. 1987.

irrigated area to be developed might be very nominal. The people in this area might benefit from improved rural roads or river training but not from bringing a large, previously unirrigated area under irrigation.

What could be an alternative investment area? What policy shifts regarding investment are required, keeping in mind the objective to fulfill basic needs? One argument against investment in rehabilitation is that this provides greater opportunity for increased production to the section of the population that is comparatively better off already. Increased irrigation facility means access to higher productivity with improved seed and fertilizer. The Rasuwa/Nuwakot rural development program impact indicates that the World Bank-funded Rasuwa/Nuwakot Project helped the farmers of the river valleys more, where they have access to irrigation. Equity issues need to be considered. Why not go to new areas? Technology appropriate to providing irrigation facilities to new areas and to less privileged people needs to be developed. Along with the fulfillment of basic needs, extension of the means of production to the less privileged should also be considered in the selection of projects.

CHAPTER 3

Small-Scale Irrigation Development in Nepal

A Uniform Policy

TWO AGENCIES ARE directly involved in small-scale irrigation development: the Agricultural Development Bank of Nepal proposes to promote irrigation development through private initiatives by granting loans, and the Department of Irrigation provides grants for irrigation development.

Keeping in view the overall strategy for irrigation development, a uniform policy enforced by both the Department of Irrigation and the Agricultural Development Bank of Nepal would be useful. The uniform policy should provide for the following.

1. Beneficiary participation should be made compulsory in the identification, design, development, and maintenance of a system.

2. The grant/loan ratio needs to be uniform irrespective of the implementing agency.

3. Irrigation development activities should be undertaken through a water users' group in which all beneficiaries hold membership.

4. A minimum size command area or the number of beneficiaries qualifying for assistance needs to be specified with the objective of providing benefits to a large group of people.

5. The willingness of the beneficiaries to contribute labor/cash should be considered.

6. A ceiling for grant/loan assistance must be fixed, based on either the total amount or per hectare cost.

7. The responsibility of the district or the regional office must be spelled out regarding the amount of resources that can be spent for particular projects.

Institutional Rearrangement for Irrigation Development in Nepal

At present, one of the issues in irrigation development is how to bring technical and institutional development together. For the last 30 years, irrigation agencies have focused on the technical questions of constructing systems. Limited attention was given to strengthening and developing institutional and management capacity through water users' associations and the participation of the farmers in irrigation management. Institutional development aims at improvement of the systems through farmer participation. One of the major thrusts of the 1988 Sector Loan Strategy is to promote the participation of the farmers during the identification, construction, and O&M of the system.

The institutional development question hinges on the legalization of water user associations, farmers sharing responsibility for O&M of the system, establishment of a water fee collection mechanism, and joint management or transfer of management responsibilities from the agency to the farmers. This implies that a new relationship must be established between the agency and the water users. The government must assume a supportive role and convince the beneficiaries that by sharing the responsibility for O&M they will be assured of a more reliable water supply through more control over their system.

Water user associations do not have a legal status. They cannot enter into any meaningful interaction with the agency. There has been a recent realization that to promote the participation of farmers, legal status must be given to the water user associations.

Besides legal recognition for water user associations, there is a need to organize and train farmers to make the association functional. The formation of functional water user associations requires the dedication of agency time and energy. Not only is there a need to educate the irrigators to achieve a viable irrigation organization, but agency technical support staff need to accept the association as a resource for better management of systems.

A national policy to promote the participation of farmers in the design, construction, and O&M of the system needs to be established. Policy-level officials must be committed to such a policy.

Reorganization of Irrigation Agencies

The Department of Irrigation has been reorganized with the provision of five Deputy Director Generals to look after specific division activities. These are the: 1) Small Irrigation and Water Utilization Division, 2) Large and Medium Irrigation Division, 3) Groundwater Division, 4) Planning and Management Division, and 5) River Training and Environmental Division.

The irrigation development responsibilities of the Farm Irrigation and Water Utilization Division (Department of Agriculture) and the irrigation activity responsibilities of the *Panchayat* and Local Development Ministry are amalgamated in the Department of Irrigation. The Agricultural Development Bank of Nepal is given greater responsibility for irrigation development. Previously, activities of the Bank were confined only to small farmer development projects. With the reorganization of the irrigation agencies, the Bank can undertake activities throughout the districts and it does not have to confine its activities only to small farmer development projects.

The Regional Directorates, five in number, are strengthened to provide technical assistance and supervision to the District Offices.

District Irrigation Offices were established in 70 districts. Wherever the Regional Directorate is located, it functions as the District Irrigation Office as well. It has the responsibility of implementing the Decentralization Act. It is responsible for undertaking feasibility studies, construction and implementation of district-level projects -- once they have received approval -- river training, and organizing the beneficiary groups to manage the irrigation systems after completion.

The District Irrigation Office also provides assistance for repair, rehabilitation, and improvement of farmer-managed irrigation systems. In doing so, local resources will be mobilized and the participation of the beneficiaries will be promoted (Gorkhapatra, 11 May 1988).

The irrigation sector is going through a rapid transformation from being construction-oriented to being management-oriented. However, the transition

will take some time and a 140 percent increase in the 1988/89 budget has again forced the Department to give priority to construction activities because evaluation of the Department and its personnel is based on the amount of project expenditures made. Construction of infrastructure usually costs more, and therefore the Department is compelled to give more emphasis to this aspect with the result that management development and other lower cost alternatives receive little attention. Nevertheless, if the irrigation sector is going to achieve its target growth and then sustain the O&M of the expanded irrigated area, policy directives and resources must be directed to encourage the participation of the beneficiaries, and a management perspective for the Department of Irrigation.

There are two unconventional types of projects in the Department. They are the Irrigation Master Plan and the Irrigation Management Project. Both these projects aim at strengthening the capacity of the Department to respond to the new challenges mandated by the new government policy.

The Irrigation Management Project is based on the premise that better management of already-developed systems will produce benefits faster than will the development of new, larger schemes. This suggests that improved management of already-developed medium and small systems will help develop irrigated agriculture in Nepal.

"To maximize gain in overall agricultural production, top priority should be given to improving operation and maintenance in irrigation systems which are government operated. This means working both with irrigation department managers and with groups of farmers who manage water at the tertiary levels of the government systems" (Svendsen et al., 1984:vi).

Under an agreement between His Majesty's Government of Nepal and the USA, the Irrigation Management Project came into existence. It created two important elements for better management of the irrigation systems: the System Management Division and the Irrigation Management Center. The System Management Division's mandate is to devise and monitor improved O&M methods. For the first time, a division has been created under the Department of Irrigation that is responsible for issues related to irrigation system management. The Irrigation Management Center has the mandate to train irrigation personnel and undertake applied studies in order to improve the quality of training and provide input in decision making.

The Sirsia-Dudhaura Pilot Site

Sirsia-Dudhaura at Parwanipur was selected as the pilot site for the application of the irrigation management system. A water user association and water user groups were formed among the beneficiaries, and farmers were regularly consulted in structural improvement activities. Both physical and non-physical improvements took place in the system. Many useful lessons have been learned from this exercise at the Sirsia and Dudhaura systems.

The Sirsia-Dudhaura farmers organized themselves to clean about 32 kilometers of field channels within the command area. After many years of neglect, the increased volume of water available from the clean canal helped to decrease water-related conflicts, improve the reliability of water, and allow a greater area of wheat to be irrigated than in the previous year. Better communications were also established between the farmers and agency personnel.

This project suggests that non-physical aspects such as organizing the farmers in an association and including them in the management of their system are very important. The project sent association organizers to the field to promote the formation of water user associations. The association organizers work as facilitators, catalysts, and links between the agency and the farmers. After the formation of an association, the association organizers are moved out of the system. The Sirsia-Dudhaura system is going through the process of being jointly managed.

In addition to this joint-management exercise, the Irrigation Management Project is experimenting with the turnover of the system at Hadetar from agency management to management by the beneficiaries.

There are systems of 100-200 ha which are being managed by the agency that can be handed over to the farmers for management. The farmers have proven on many occasions that they are capable of managing even larger irrigation systems. In order to activate this program, legal provisions and procedures need to be established to identify the candidate systems and work out the process of handing over the systems.

In summary, the Department of Irrigation has to work in two fronts at present in order to achieve the objective of fulfilling basic needs. It is true that addition of new hectarage under irrigation alone is not sufficient to increase agricultural productivity to the target level. Programs need to be worked out to improve the management of the existing systems as well. Examples from many countries have proven that nonphysical improvements in irrigation

systems have contributed to increased agricultural production. This raises the question of how the Department of Irrigation can establish a responsive management system in the already-developed area. Farmer participation must be instituted in order to achieve better management, cost sharing, and resource mobilization. The approach of the Department of Irrigation must balance construction activity and nonphysical improvements.

Research Efforts

There has been little research on physical, hydrological, or social science aspects of irrigation systems in Nepal. Interaction between national research institutes and the irrigation agency needs to be established and a strong relationship encouraged so that research findings can be transferred and applied. Research activities of the Institute of Engineering, the Institute of Agriculture and Animal Sciences, the Centre for Economic Development and Administration, and the Agriculture Projects Services Centre should be coordinated with the needs of the irrigation sector of Nepal. At present there is no dialogue between these research agencies and implementing agencies.

The International Irrigation Management Institute (IIMI) is undertaking research activities in collaboration with the Water and Energy Commission Secretariat. One of its research activities is to identify appropriate procedures for assisting farmer-managed irrigation systems in the country. This action research has relevance in the Nepal context because over 60 percent of the irrigation systems are farmer-managed and many could benefit from some government assistance. An inappropriate assistance procedure might make them dependent on the government. Hence, care must be taken to learn how these systems might be best assisted without hindering their capacity, organization, and work procedures. The government must encourage the research institutes to participate in important research activities relating to irrigation and to open up dialogue with the implementing agencies.

Promoting Farmer Participation in Agency-Managed Irrigation Systems in Nepal

At the policy level, there has been frequent reiteration that farmer participation is to be encouraged in the management of irrigation systems. Directives issued by His Majesty, King Birendra also emphasize beneficiary participation in irrigation system management. However, there are many intrinsic factors that inhibit the promotion of the farmers' participation.

The number of farmer-managed systems in Nepal that have informally organized water user groups runs into thousands. There is a long tradition of these informal groups performing the functions important for irrigation on their own. The government has to be careful to safeguard the potential and resources of the people and provide the legal support to make it possible for them to continue to function, perhaps more effectively. To promote association and farmer participation in management, the following concerns should be carefully considered and action taken to promote a positive environment that will capitalize on the farmers as a resource.

1. Institutional and technical development must relate to each other. Engineers have to help develop the institutional strength of the farmers. This requires reorientation of engineers to accept the farmers' organization as a resource for better management of the irrigation system. Lessons learned from Sirsia-Dudhaura and the Water and Energy Commission Secretariat/Ford project in Sindhupalchok provide methods for encouraging farmer input during survey, design, construction, and monitoring of progress.

2. The present accounting procedure and contract provisions enforced whenever the government aids a project discourage the active and organized participation of the farmers. The farmers are allowed to work as individuals but not as an organized group during irrigation construction activities. If the farmers are encouraged to organize themselves for structural improvement activities they would learn valuable lessons which would help prepare them to manage the responsibility of O&M. The deployment of association organizers to organize the farmers into water user associations is not sufficient for achievement of effective participation of the farmers in system management. Changes in accounting and contracting procedures also need to be made, and an innovative approach is necessary.

3. There is no legal recognition of the water user associations, so they are not allowed to participate actively. This is the case both in FMIS and agency-managed systems.

4. Dialogues are initiated between the agency and organized groups of farmers, but there is no way to implement or enforce any agreements reached between them.

5. Frequent employment of outside contractors for essential structural improvements weakens the farmers' interest in participation. Outside contracting does not provide them opportunities to learn management skills as a group of farmers or as association members. Hence, essential structural improvement should be part of the process for promoting participation.

CHAPTER 4

Recommendations

Two sets of recommendations regarding agency-managed systems and farmer-managed systems are given below. These recommendations were prepared by IIMI staff and presented at the Irrigation Sector Coordination Meeting of February 1988. They are valid recommendations worth considering for long-term planning for irrigation development in Nepal. Only the outline of the recommendations is presented here.

Recommendations for Organization and Management of Government Systems

Options for agency-managed systems.

1. Increase the level of farmer participation in joint management of large systems, and insure agency staff and farmers have specifically defined O&M tasks.

2. Turn over ownership and management of small systems to farmer organizations.

3. Shift from an administrative to a management mode in large systems.

Recommendations for O&M in jointly managed systems.

4. Routine maintenance should be considered a part of operations and separate from emergency or catastrophe maintenance.

5. A mobile team and a centrally funded budget should be established to respond to catastrophes.

6. Farmers should be given the major responsibility for O&M.

7. Effective farmer organizations need to be formed, including a federation of field channel groups at the subsystem and system levels.

8. Define water allocation and monitor the water distribution system as a management tool as well as a basis for mobilizing resources from farmers.

Recommendations for resource mobilization in jointly managed systems.

9. The cost of O&M should be borne by the beneficiaries.

10. All irrigation service fees paid by farmers should be locally retained for use in the system in which they are collected.

11. Farmers should have the option of paying fees in cash or in-kind.

12. All accounts and transactions should be open for inspection by farmers and agency staff.

Recommendations for Farmer-Managed Irrigation Systems

Since irrigation systems constructed, operated, and maintained by farmers account for the major portion of irrigated agriculture in Nepal, and conservative estimates indicate that production from FMIS is feeding over 30 percent of

Nepal's population, the farmer-managed irrigation sector deserves more attention. The contribution of FMIS to the basic needs of the country is already high but it can be increased further if carefully conceived and implemented. Government assistance is provided to strengthen the infrastructure and farmers' management.

In both the hills and the Tarai, farmers face increasing difficulty in operating their systems due to deforestation and government policies protecting forests. Furthermore, as the nation seeks to bring increasing areas of new lands under irrigation, government resources will be insufficient to cover operation and maintenance costs. To compensate, the Department of Irrigation needs to integrate the participation of the farmers at appropriate levels in the management of irrigation systems. Investment in strengthening FMIS to increase their productivity can be achieved at a cost lower than that of agency-managed systems. The following are recommendations concerning farmer-managed irrigation systems. (Refer to Appendix IV for a detailed description of FMIS. Appendix V provides the rationale for each of the recommendations outlined below.)

Recommendations to give appropriate recognition to FMIS.

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

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

Recommendations for providing assistance to FMIS.

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

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

5. Establish criteria for selecting systems for assistance.

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

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

8. Ensure the design process for improvements to FMIS are simple and field based.

Recommendations for administrative reorientation.

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

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

11. Provide orientation and training to all levels of Departmental staff dealing with FMIS to enable them to implement a participatory approach when assisting these systems.

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Appendix I

PRODUCTIVITY OF IRRIGATION SYSTEMS IN NEPAL

Name of the system	Total value (Rs/ha)	Yield MT/ha/yr. %	Cropping intensity	Type of management	Location	Area (ha)	Predominant crops in order of importance	Existence of users' organization
Phewa	2557	5.84	155	Agency	Hill/Valley	280	Rice, Maize,Wheat Mustard	No
Hyanja	8730	3.0	130	Agency	Hill/Valley	300	Rice, Maize, Wheat, Potato, Millet	Yes
Sangey Patiyani	13557	3.5	200	Agency	Hill208		Late/Early Rice, Wheat, Mustard, Maize	Yes
Char Hazar	9453	3.3	120	FMIS	Hill/Valley	200	Rice, Wheat	Yes
Bhanu Bhairah	19004	6.25	187	FMIS	Hill/Valley	120	Late/Early Rice, Wheat, Lentil, Potato, Mustard	Yes
Char Saaya Phant	22539	7.0	250	FMIS	Hill	50	L/E Rice, Wheat	Yes
Satra Saya Phant	30458	7.0	272	FMIS	Hill	40	L/E Rice, Wheat, Maize, Peas. Lentil, Potato, Vegetable	Yes
Yampa Phant	28019	7.75	275	FMIS	Hill	40	L/E Rice, Wheat, Maize,Lenti	Yes
Pancha Kanya	18738	6.7	179	Agency	Tarai	600	Rice, Mustard, E.Rice, Wheat, Maize	Yes
Pithuwa	22547	4.12	235	FMIS/ Agency	Tarai	1300	Rice, Mustard, Maize, Potato	Yes
Kamala	16546	4.27	200	Agency	Tarai	12500	Rice, Wheat, Mung, Tobacco, Potato	No
Kankai	17572	3.61	185	Agency	Tarai	4000	Rice, Wheat, Jute, Oil,Pulse, Early Rice	Yes

Name of the system	Total value (Rs/ha)	Yield MT/ha/yr. %	Cropping intensity	Type of management	Location	Area (ha)	Predominant crops in order of importance	Existence of users' organization
Lothar	22822	7.63	203	FMIS	Tarai	1000	Rice,Wheat,Maize,Mustard, Pulse	Yes
Surtan	22396	7.93	187	FMIS	Tarai	273	L/E Rice,Wheat,Mustard,Maize,	Yes
Amraha	24556	6.23	197	FMIS	Tarai	260	L/E Rice,Wheat,Hybrid maize	Yes
Kerbari	43337	8.94	280	FMIS	Tarai	200	Rice,Wheat,Jute,Mustard,Maize	Yes
Budhabare	33245	7.03	225	FMIS	Tarai	125	L/E Rice,Wheat,Jute,Maize	Yes
Argali	29672	7.5	300	FMIS	Hill	85	Rice,Wheat, Maize	Yes
Chherlung	33101	8.4	300	FMIS	Hill	52	Rice,Wheat,Maize	Yes
Argali (Irrigated *Bari*)	27254	6.8	200	FMIS	Hill	50	Maize, Wheat	Yes
Majuwa	34165	8.0	300	FMIS	Hill	73	L/E Rice, Wheat, Maize	Yes
Thambesi	13492	3.44	116	FMIS	Hill	30	Rice, Wheat, E Rice	Yes
Goberdia	11159	2.53	165	FMIS	Tarai	800	Wheat,Maize,Mustard, Blackgram	Yes
Dharmawati	26186	6.55	195	FMIS	Hill/valley	364	Rice, Wheat	Yes
Chandra Nahar	11944	2.72	162	Agency	Tarai	10500	Rice, Wheat,Linseed,Mustard, Maize, Pulse, Jute	Yes

Handetar	13586	3.42	131	Agency	Hill	165	Rice, Wheat, Maize	No
Sodiyar	14057	2.44	190	FMIS	Tarai	87	Rice,Wheat,Lentil,Mustard, Flax	Yes
Masina Sat Tale	15169	3.8	190	FMIS	Tarai	147	Rice, Wheat	Yes
Torbang	35180	6.73	200	FMIS	Hill	30	Rice, Wheat, Potato	Yes
Harsabang	24569	5.5	200	FMIS	Hill	5	Rice, Wheat, Potato	Yes
Darmakot	16185	4.09	200	FMIS	Hill	34	Rice, Wheat	Yes
Chaurjahari	24026	6.04	200	FMIS	Hill	30	Rice, Wheat	Yes
Dhanauri	10753	2.5	197	FMIS	Tarai	27	Rice, Wheat, Lentil,Chickpea	Yes
Goth Khola	23273	5.14	187	FMIS	Hill	20	Rice, Wheat, Lentil	
Tedi-Gurgi	12420	2.48	195	FMIS	Tarai	5500	Rice, Lentil, Linseed, Wheat	Yes

Note:

1. Total value (in Rs) of crop yield (ton/ha/year) is as per the average national retail price of 1986/87. Data source for price: Department of Food and Agricultural Marketing Service, Nepal, 1988.

Data Source:

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f) Sodiyar to Goth Khola	- Development Research Group, 1986. Rapti rural area development project minor irrigation appraisal study report. Lalitpur, Nepal: Development Research Group.
g) Tedi-Gurgi System	- Yoder, R.; Pradhan, R.. Prachanda; Tiwari, Dirga Nidhi; Shrestha, Madhar. 1987. Rapid appraisal report of the Tedi/Gurgi farmer managed irrigation system of Kailali District. Unpublished mimeo. Kathmandu, Nepal: International Irrigation Management Institute.

Appendix II

Resource Mobilization in FMIS in Nepal

RESOURCE MOBILIZATION, THE degree of organization required for operation and maintenance of a system, and water allocation and distribution are interrelated aspects of the operation and management of farmer-managed irrigation systems. A better understanding of resource mobilization in FMIS can help develop an appropriate strategy for assisting these systems and examples of the practices in these systems can also help the government to develop policies for resource mobilization in the irrigation sector as a whole.

The types and kinds of resource mobilization are categorized on the basis of case studies of 21 farmer-managed irrigation systems in Nepal. Information gathered from the 21 systems indicates that resource mobilization can broadly be grouped into internal and external resource mobilization. Resources mobilized from within the system itself are categorized as internal resources. These may encompass local labor, cash, materials, natural resources, animal power, and enterprises operated by the system. External resource mobilization is the use of resources from outside the community for rehabilitation or operation of the systems. These may include cash, materials, and technical expertise.

Types of Internal Resource Mobilization

Labor mobilization. The primary resource that almost all farmer-managed systems must mobilize is labor for operation and maintenance. The basis for labor mobilization is different among the systems of Nepal. The size of landholding within the irrigated area, the number of households in the irrigation community, or the water share may be the basis upon which labor mobilization is assessed. In some systems, committee officeholders are exempted from

labor contributions as compensation for performing their official duties. Labor contributions are not voluntary; the right to use irrigation water is obtained by contributing labor for O&M of the system. If the user fails to contribute the labor assigned to him, he is fined or deprived of irrigation water.

Cash mobilization. In lieu of labor, some systems collect money to hire laborers from outside the system. This fee is assessed on the basis of crop yield from the irrigated land or in proportion to the size of the area irrigated. Some systems collect cash for the construction of physical infrastructure, to pay fees to the Forest Department for the right to cut forest products used for river diversion work, or to pay salaries to their irrigation officials. Cash is also accumulated from the fines imposed upon the members of the irrigation system who had not fulfilled their irrigation obligations.

Mobilization of forest products. FMIS usually have temporary structures made of stones, boulders, branches of trees, logs, and bamboo. These materials are used for river training, diversion dams, and intake and check dams for raising the water level. These materials are heavily relied upon in large-scale farmer-managed irrigation systems in the Tarai.

Mobilization of bullock carts. In some places, the temporary dam site is far from forests and rivers where forest products, stones, and boulders are collected. Hence, bullock carts are necessary for transporting these materials. The FMIS at Tedhi Gurgi, Kulariya and Jamara, and Babai mobilize bullock carts for transportation of materials.

Irrigation enterprises. The Chherlung Thulo Kulo System is an example of an FMIS establishing a system-owned water mill. This hill system requires frequent maintenance during the monsoon. Profits generated from the operation of the mill are applied toward the operation and maintenance costs of the irrigation system so that the labor contributions of the beneficiaries can be reduced.

Similarly, one of the irrigation systems of Majuwa has permitted a mill owner to use irrigation water for running a water mill. In exchange, the mill owner is required to maintain the canal from the intake up to the mill site, reducing the labor contributions required from the other water users.

Sale of water. When the volume of water available is in excess of the system's needs, the excess water can be sold and the funds used for improvement or maintenance of the system. This has been done in Chherlung. The Argali Raj Kulo has also sold water to raise funds for improvement of the local school. Water share transactions also occur among individual shareholders. The additional beneficiaries must also contribute labor for system O&M, thereby increasing the system's labor resource.

Mobilization of local expertise. The knowledge of local leaders and elders gained from years of experience with system operation and maintenance is a valuable resource existing within many systems. For example, the expertise of tunnel makers has been utilized in some hill irrigation systems. Also, farmers in one irrigation system may have knowledge about O&M practices that would be useful in another system, and they have helped to disseminate and transfer knowledge from one system to another.

Types of External Resource Mobilization

Cash mobilization. Funds received from either the national, district, or village *panchayat* government, from voluntary organizations, or from international agencies come under external resource mobilization. These funds have been used for the improvement of irrigation systems and sometimes to meet regular maintenance costs.

The Development Research and Communication Group, a Nepalese voluntary organization, has given money to the Gharaphant irrigation system for tunnel repair. Bread for the World and the German Voluntary Organization are other examples of voluntary organizations providing funds to FMIS.

In the government-funded Farm Irrigation and Water Utilization Division program, the agency provides 70 percent of the cash needed for irrigation rehabilitation or construction and the farmers must provide the rest, usually contributed as 5 percent cash and 25 percent labor.

Material mobilization. Materials such as gabion wire, cement, pipes, or food for workers have been provided by the government and various international agencies for system improvements.

Technical expertise. Government engineers, surveyors, and association organizers are some of the external technical resources utilized by FMIS. This resource is usually provided by the technical agencies of the government. Farmer-to-farmer training programs and farmer consultancies have also recently provided opportunities for farmers from one irrigation system to learn about improved irrigation practices from farmers in other systems. There have also been examples of individuals in the irrigation field providing their personal expertise to an irrigation community. For example, Dr. Robert Yoder has provided assistance to the Chherlung community regarding the operation of a water mill. Technical experts may also supervise work performed by the local people.

Machinery mobilization. Bulldozers or excavators may be brought into the system at the time of desilting or canal repair. This occurs in Pithuwa for regular desilting of the canal after each flood and in Chhattis Mauja for desilting during annual canal maintenance. A bulldozer provided through the Tikapur Development Board was brought in to desilt the East Kailali irrigation system in 1987.

Credit mobilization. FMIS have received different types of credit from agencies outside their community for irrigation development. The Agricultural Development Bank provides credit for shallow tube well system development. The Asian Development Bank/Small Farmers Development Program and the Asian Development Bank/Cooperative for American Relief Everywhere (CARE) Nepal Program have provided credit to irrigators. Under the Asian Development Bank/CARE program, CARE provides a grant to cover 50 percent of the costs and the farmers must provide the rest. This might be in the form of labor contributions plus credit from the bank. The Agricultural Development Bank provides loans to farmers for irrigation development.

Policy Implications

The political strength of an irrigation organization and its capacity to mobilize external resources are closely related and need to be considered in the

government's total political and economic policy. Is the government prepared to take over all the farmer-managed systems or will it provide assistance as and when it is necessary? In the absence of a policy for assistance, nonirrigators are being incorporated into irrigation organizations in order to pressure the government for more resources.

A strategy of government assistance needs to be formulated which will take into account the irrigation systems' existing capacity and ability to mobilize resources. In many cases, the strength of the existing irrigation organization is closely tied to the nature and extent of the resources that the system must mobilize. Therefore, in the plan to strengthen water user organizations, resource mobilization must be considered, and any plan for government intervention must take this relationship into account.

The resource mobilization perspective can be used as a tool for understanding how FMIS function, and at the same time it can identify areas in need of assistance.

Appendix III

Proposed Definitions of Project Size

THE FOLLOWING IS a summary of the definitions of project size and cost sharing responsibilities of the government and beneficiaries as proposed in the Sectoral Lending Strategy Issue Paper (Department of Irrigation, 1988:6-8).

Small Schemes

To reduce the financial burden to the government, investment in construction of irrigation facilities and in the promotion of farmer participation and sense of beneficiary ownership, the government shall contribute 75 percent of the construction cost in the form of a grant and the farmers shall contribute 5 percent cash and 20 percent in either labor contributions or as cash obtained through loans from the Agricultural Development Bank, if: 1) the project is feasible, 2) there is a formal water user association, and 3) the estimated cost of the project is not more than Rs 3 million.

For schemes with an estimated cost above Rs 3 million, the Department of Irrigation shall be responsible for the construction of headworks and the main and branch canals. The beneficiaries shall provide land for canal construction, pay the cost for tertiary channels and farm ditches, and be responsible for the O&M of the scheme.

Large and Medium Irrigation Schemes

The government should undertake the construction of large- and medium-size irrigation projects. The water user association will be responsible for the

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construction of field channels covering a block of 10 ha, and operate and maintain the irrigation facilities for a block of 50 ha. The government will subsidize the capital cost recovery of the project.

Farmer-Managed Systems

The beneficiaries of farmer-managed systems will contribute 25 percent of the cost for improvements in cash and voluntary labor. Seventy-five percent of the total cost will be granted by the government. The user group will be responsible for system operation and maintenance.

Groundwater Development

Shallow tube wells. For the construction of shallow tube wells, 75 percent of the capital cost of the project should be borne by the farmers and 25 percent will be made available as a grant. Loans from the Agricultural Development Bank to the farmers will be facilitated. Should individual farmers want to construct shallow tube wells at their own expense, they can also apply for the 25 percent government grant. The same cost-sharing formula will be followed for construction of ponds and wells for irrigation purposes.

Deep tube wells. For deep tube well systems, the Department of Irrigation shall be responsible for construction up to the tertiary canals. The user group will be responsible for the construction of the distribution system for a block of 10 ha. They should take the responsibility for operation and maintenance. After the project is completed, the beneficiaries should contribute to help pay the capital cost. In the case where an individual farmer or farmer group seeks to construct a tube well using their own financial resources, 25 percent of the total cost will be provided as a grant from the government.

Collection of Water Charges

The principles that will be adopted for the collection of water charges according to category are:

Category I. In the case of schemes constructed and completed by the government without beneficiary contributions, water charges will be collected by the government as per the set rules and regulations.

Category II. In those schemes where the beneficiaries contribute to part of the construction costs and the whole of the operation and maintenance costs, no water charges will be collected by the government.

Category III. In those schemes where the main and the trunk systems are constructed and maintained by government and the beneficiaries contribute only to the construction and maintenance of the distribution systems limited within the block area, some concession in water charges will be made. The amount of the concession will depend on the size of the block.

These categories have been proposed in an effort to collect water charges in order to meet operation and maintenance costs. Past experience in water charge collection has influenced this proposal, although adjustments may have to be made in the context of changes in the overall sector policy.

Appendix IV

FMIS In Nepal

Nature and Characteristics

THE LIMITED FUNCTION of the government and the tradition of nonintervention in irrigation water management at the community level for hundreds of years led to the development of farmer-managed irrigation systems in Nepal. Over 60 percent of irrigated agriculture in Nepal is covered by farmer-managed irrigation systems. By and large, these systems are autonomous, self-governing entities.

The role and functions of farmer-managed irrigation organizations differ according to the type of system: hill irrigation systems, river valley irrigation systems, and Tarai systems. The physical characteristics influence the intensity of a particular task, from water acquisition, allocation, and distribution to management, to be performed by the irrigation organization.

Size of FMIS. Farmer-managed irrigation systems are not restricted to small units. Systems as small as 10 ha and some as large as 15,000 ha have been identified in the country.

Irrigation tasks performed by FMIS. By and large, irrigation organizations perform water acquisition, water allocation and distribution, resource mobilization, system maintenance, and conflict resolution tasks. These are interrelated irrigation tasks. However, the level of organizational sophistication differs in accordance with the type of task to be performed by the organization.

Organizing forces. An organization need not necessarily perform all tasks in order to keep functioning. The organization might be forced to come into existence and continue its existence only for the performance of one or two

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tasks. For some systems, water distribution alone might be the cementing factor for organization and in others, it might be only resource mobilization, while yet in other systems, the preservation and safeguarding of water rights at the source might be the compelling force. However, irrigation tasks might be performed through contractual arrangements employing other people. Hence, the cementing factor for organization in each system differs.

An irrigation organization comes into existence to perform certain tasks for making the system work. However, the organization may also degenerate and disorganize or change its role when change takes place in the resource endowment within the environment of the system. In one system, seepage water from another irrigation system built in the upper reach supplemented water to the main canal; this extra resource -- water in the system -- made resource mobilization of labor or cash unnecessary. Previously, the irrigators' organization had to organize for water acquisition and when this was no longer a major task the organization gradually disintegrated.

In another system, access to a road and the movement of the young people in search of opportunities elsewhere prompted distribution of water and maintenance tasks to be carried out through contractual arrangements. Cash contributions instead of labor contributions were required to obtain the contract services. This has changed the whole complexion of the problem of labor mobilization for maintenance.

Irrigation systems in Nepal are geared for rice cultivation and management of irrigation is intense during the season. Most of the committees are active from July to August. After rice harvest, many of the irrigation organizations become inactive. During the winter season the farmers act individually or in small groups to divert water to their fields as needed, with little involvement of the system's irrigation organization.

Flexibility to respond to changes and needs. The intensity of the task that an irrigation organization performs is sensitive to the environment. Change in one environmental factor, whether physical or socioeconomic, influences how that task is performed by the organization. Farmer-managed organizations are flexible, tailoring their methods for water acquisition, labor mobilization, and water allocation and distribution to the needs of the farmers.

Farmer irrigation organizations can be the result of deliberate government efforts to establish such organizations. There are also examples where farmer irrigation organizations came into existence because of government neglect of

the system: in Pithuwa, water used to be delivered by government employees. Since the government was in charge of the water resource, the farmers believed there was no harm in extracting more resources from the government. This situation created anarchy in the system. Some enlightened farmers thought of organizing themselves to achieve an equitable distribution of water, and they came to regard the irrigation resource as community property. This transformation in the concept of property helped to form the farmers' irrigation organization in Pithuwa. The government did not play any part in this process.

Characteristics of Farmer-Managed Irrigators' Organizations

Annual meeting. Decisions regarding irrigation water management are made by the irrigators as a body at their annual meeting. They decide on the plan, and program for different irrigation tasks, review the performance of the previous year, audit and settle accounts, and elect officeholders.

Management committee. The irrigation management committee carries out the decisions of the general body of irrigators. The performance of the officeholders is reviewed each year. Officeholders are accountable to the farmers as a body.

The number of members in the committee is determined by the size of the organization, the intensity of the water distribution tasks, and the amount of labor to be mobilized. Where water distribution or labor mobilization is not a problem, systems may even be managed by one person assigned by the community. However, in a small system with only a 17 ha command area (Tallo Kulo), the system is managed by a 10-member committee. Here, the intensity of task performance in water acquisition, distribution, labor mobilization, and system maintenance is so high that the collective effort of a large group of people is required all the time.

Two types of irrigation leaders heading the committee have been observed: hereditary and elected leaders. The hereditary irrigation leaders are generally found in those places where people have recently settled and the system of electing leaders has not been established yet. However, both types of irrigation leaders are subject to renewal each year.

Remuneration to committee members differs across systems. Cash or in-kind remunerations are observed. There are systems where no remuneration is provided. However, the committee members' performance does not necessarily depend on the amount of remuneration. Because committee members are also beneficiaries of the system, the benefit that they derive from agriculture depends on the performance of the irrigation system, so their contribution to irrigation management is a self-benefiting job. Their identification with the system and commitment to the system are the basic factors motivating them to participate in management.

Constitution, rules and regulations. Many of the farmer-managed systems do not have a written constitution or written rules and regulations. The rules and regulations governing irrigation water management are known to all within the community. It is not necessary to have a written constitution. Regular interaction between the committee and irrigators is more important.

Levels of organization. Levels of irrigation organization depend on the size and complexity of the task to be performed. Each level has specific tasks. Lower levels are generally responsible for resource mobilization, water distribution, and maintenance of harmony in the small community. In farmer-managed systems, independent field channels are usually constructed from the main canal to each village to avoid conflicts between villages.

Resource mobilization. The basis for resource mobilization differs from system to system. Resource mobilization may be based on size of landholding, water share, outlet size, village units, or number of households in the command area. Besides resource mobilization for regular activities, there are provisions for resource mobilization during emergencies. Structural weaknesses are compensated for by strong management in resource mobilization to keep the system functioning.

Water allocation and distribution. Water allocation and distribution are important tasks for the irrigation organization. Allocation may be based on the size of landholding, water share, number of households, by village, or by lottery. Water may be distributed in relation to the allocation principle through proportioning weirs *(saachos)* or measured outlets.

Distribution needs intensive supervision. Elaborate distribution schemes are developed where the water supply is barely sufficient. If proper distribution is not done, many suffer. Where there is abundance of water in the system, water distribution is not the major task. Hence, water distribution is dependent on the availability and the quantity of water in the system.

Water as a community resource. In farmer-managed systems, water is conceived as a resource owned by the group. The acquisition of water is a community effort. Hence, the principle of water allocation and water distribution is determined by the community as a whole. The community allocates water to the individuals. The allocation principle is observed by all. Any violation of the allocation principle by an individual is subject to penalty. The conditions of the penalty are determined by the community.

Conclusion

The Government of Nepal is trying to formulate rules and regulations regarding water user associations and user committees for irrigation management. Some of the principles and operational rationale of farmer-managed systems can serve as useful guides in the formulation of meaningful rules and regulations aimed at achieving the participation of farmers in irrigation water management of agency-managed and jointly managed systems.

Appendix V

The Importance of Assisting FMIS[4]

IN THE PAST 10 years, awareness of the scope of FMIS in Nepal and the contribution these systems make to the national economy have increased. These systems are spread over all districts of the country and range in size from less than 1 ha to a federation of systems, managed by a central committee, covering more than 15,000 ha.

The total number of systems is unknown. Extrapolated information from a detailed inventory of one river basin in a hill district and land resource maps indicate that there are probably over 17,000 FMIS in the hills. Inventories of all the Tarai districts have identified over 1,700 farmer-managed systems in that region which provide some level of irrigation to at least 450,000 ha.

These systems and the farmer organizations which operate and maintain them are a unique national resource which must be preserved and improved. According to conservative estimates, the production from farmer-managed irrigation systems feeds over 30 percent of Nepal's population.

Farmer-managed irrigation systems in Nepal present a wide variation in the type of organization and management style, methods of both internal and external (to the system) resource mobilization, maintenance practices, and water allocation and water distribution methods. Each of these FMIS has a distinct character which is determined by adaptation to the environment and needs of the people it serves. In most systems the low quality of physical structures is compensated for by careful management of the available human resource.

While some of these systems are well-managed and achieve a high level of agricultural production, many systems benefit from assistance from the Department

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[4]Paper presented at the International Irrigation Sector Coordination meeting by staff from the International Irrigation Management Institute in Kathmandu, Nepal on 22 February 1989.

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of Irrigation. In both the hills and Tarai, farmers face increasing difficulty in operating their systems due to deforestation and government policies protecting forests that have traditionally provided the materials necessary for maintenance.

The contribution of FMIS to the basic needs of the rural population is already high but can be increased further. The unique resource of human organization and extremely diverse physical infrastructure represented by FMIS should be preserved and assisted in developing further. In determining ways to improve the functioning of FMIS and to devise appropriate ways to assist them, the following recommendations should be considered under the master plan.

Recomendations To Give Appropriate Recognition To FMIS

1. *Provide legislation that establishes the legal identity and rights of the beneficiary groups operating irrigation systems.* At present, the farmer organizations managing irrigation systems have no clear legal status. This makes it difficult for them to mobilize resources external to their organization. For example, it is difficult for banks to give a loan to a group of farmers to make improvements in their system. Frequently, hundreds, even thousands of families are members of the association, with their own "formal" rules and regulations for operation and maintenance of a system. However, these associations of farmer irrigators are informal in terms of legal rights. They should be able to register their association and receive rights over the water which they are using and be able to deal as a formal enterprise with banks and government agencies.

2. *Identify existing FMIS in the area of each new agency project and incorporate their physical and organizational structure into the new system with minimum disruption.* Whenever a new irrigation project is proposed, one of the first steps should be to identify all of the existing FMIS in the projected command area. To ensure that this happens, the terms of reference of the consultants or agency staff that do the preliminary investigation should require an inventory of the existing FMIS in the project area. For each system, they

should report the name, location, water source, estimated area irrigated, cropping pattern, water rights among systems, number of farm households in the association, and method of water allocation among users for each crop.

For a subsequent feasibility study, the terms of references should call for detailed information about the existing management, operation and maintenance procedures, and production of each system. A requirement for approval to proceed to a design study for a new system should be a clear indication that irrigation services will actually improve in the areas already served by FMIS and that incremental increase in agricultural production of the improved service and expanded area will justify the cost of the project. This requires that careful consideration be given to the water rights of existing systems and to discussions with present and potential beneficiaries to determine the level of cooperation there will be in expanding irrigation services.

The terms of reference for the design study should request details on how the existing systems and their organization will be incorporated into the new design. To the extent possible with the given topography, the farmers' distribution systems should be kept intact to cause the least disruption to the associations' organization and management capacity. One way of doing this is to augment the supply at the headworks of the existing system, and continue to use the existing distribution network. It may be necessary to make improvements to the headworks and within the distribution system, but this should be done in the spirit of assisting a farmer-managed system instead of overlaying it with a completely new design.

If the existing farmer organizations are effective, they should not be forced to adapt to some rigid standard format but should be allowed to retain their own organizational form and management procedures. Weaker organizations should be strengthened as a part of the assistance effort. This effort should start with the experience and capacity the farmers already have and build on their existing rules and methods rather than introducing a standard water user association format which may be inconsistent with local conditions.

Recommendations For Providing Assistance To FMIS

3. *Establish uniform assistance policies for each geographical region of the country.* Previously, four agencies were involved in providing assistance to farmer-managed irrigation systems. Each used different policies and strategies for implementing its programs ranging from 100 percent subsidy and little participation to significant contribution and participation by the beneficiaries.

Since all irrigation development activities have come under one umbrella, a uniform policy, at least on a regional basis, will need to be applied. This policy should be formulated only after a careful study of the experience of all of the agencies in the past, has been completed. The study should include field investigation to determine the impact the different levels of beneficiary input under various programs has had on the operation and maintenance of systems and ultimately on agricultural production. The study should also examine the strategy each program has used and recommend the most cost-effective and viable implementation procedures.

4. *Systematically identify all FMIS in the country on a watershed basis by making an inventory that establishes a database giving pertinent details about each system.* Comprehensive planning for improving the performance of FMIS cannot be done without detailed information about the status of individual irrigation systems. An inventory should be prepared by systematically investigating each watershed in a district to generate the first level of this information. Using the watershed as the basis of investigation allows clustering of systems that are related to each other with respect to water rights.

The inventory should identify all systems in the watershed with information such as: a) the name of the system and source, b) location, c) irrigated area, d) number of households using the system, e) extent of land and water resources utilization (e.g., How much cultivated land is unirrigated under the command of each canal? Is there water in the source that is not utilized?); and f) problems in operating the system identified by the beneficiaries. Preparation of the inventory work should include establishment of a database for easy retrieval of information, and modification and updating of it as assistance is given to specific systems.

5. *Establish criteria for selecting systems for assistance.* The inventory information should be used to identify systems where assistance is most needed

and will be most beneficial. The criteria for selecting systems for further investigation and ultimately to assist should include: a) potential for expanding the irrigated area, b) opportunity to intensify the cropping pattern by better water delivery, c) willingness of the beneficiaries to contribute a specified proportion of the improvement cost and to add new members to their association in return for their assistance in making improvements and in operation and maintenance, and d) opportunity to reduce the maintenance cost of the system.

6. *Enable beneficiaries to improve the effectiveness of operation and maintenance activities in their system and to fully participate in any physical improvements that are made by providing assistance in strengthening their organizational and management capacity.* After a system is selected for assistance, there should be an in-depth investigation to determine the existing management capacity of the beneficiaries. This should include the rules, roles, methods of conflict management, and records that they keep as well as the extent and method of resource mobilization for routine and emergency maintenance. Where improvement in their management capacity is necessary, existing practices should form the foundation for expanding their expertise.

The use of association organizers, farmer consultants with experience from well-managed irrigation systems, and training programs that include field visits to other systems where different practices are used would be one of several methods that could be used to strengthen management capacity.

7. *Beneficiaries should be encouraged to shoulder responsibility in assisting with selection of the design and in implementation of physical improvements that are to be made to their system.* The farmers themselves are the best source of information about crop preferences, soil conditions and variation over the area, stream flows, and stability of land forms, and they can provide this input to the planning and design process. Where cadastral surveys have been completed, farmers can assist in compiling accurate area estimates of the existing and potentially irrigated area to be used in designing the canal. The beneficiaries can quickly point out difficulties and bottlenecks in the system and priorities for necessary improvements in a "walk-through" of the system. The management capacity of the beneficiaries will be reenforced if they are encouraged and assisted to share responsibility for the planning, design, and implementation of physical improvements.

8. *The design process for improvements to FMIS should be simple and field-based.* Where assistance is being given to upgrade existing structures that typically carry a discharge of less than 100 liters/second and seldom more than 300 liters/second, the lengthy process of topographic field survey office design, and carefully inked drawings greatly delay the implementation process and is not cost-effective. Procedures need to be developed (and where possible adapted from the past experience of the various agencies that had been assisting FMIS) to simplify the design process to make it prompt and less costly.

Where rock cutting is required or simple structures are to be improved, accurate sketches in a field book and analysis of costs should be prepared on-the-spot. If the beneficiaries are to be responsible to contribute to the cost of the improvements and operate and maintain them in the future, they should help in selecting from alternative designs, and set the priorities for making improvements.

Recommendations For Administrative Reorientation

9. *Assistance to FMIS should be in the form of loans (subsidized to the extent necessary) instead of grants.* Assistance to farmer-managed systems should be in the form of loans, not grants. The loans could be subsidized by the government, but the principle that the farmer organization pays for a significant proportion of the investment is important. If this is the case, the organization will set priorities according to what will really benefit them in terms of improved performance and/or reduced maintenance cost. The organization should decide how much of the cost of the project it wants to pay for with its labor, and how much in materials and cash. There should be a means by which the organization as a whole can take a loan for the cash investment if necessary.

10. *A division should be established in the Department of Irrigation which is responsible for assistance to FMIS.* The approach and necessary manpower for assisting existing FMIS are sufficiently different from the design and construction of new systems so that a separate division is warranted. It should be the responsibility of this division to formulate policies.

11. *All levels of Department of Irrigation staff dealing with FMIS need orientation and training to be able to implement a participatory approach to assisting these systems.* Assistance to FMIS is a shift from considering primarily design and construction issues in which Department of Irrigation staff have considerable expertise. If the approach is to be predominantly participatory, the staff will need a new orientation that will require substantial training effort. The training will require exposure to the farmer's point of view of the cropping pattern, water rights and water requirements, and will emphasize methods for organizing water users into effective management units.