Management Transfer of Agency-Managed Irrigation Systems in Nepal: Are There Any Lessons To Be Learned from Farmer-Managed Irrigation Systems?

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CONTEXT

IN NEPAL A minority of the irrigation systems are managed by the agency and are called Agency-Managed Irrigation Systems (AMIS) where the Department of Irrigation (DOI) is the responsible institution either through the autonomous Boards or the District Irrigation Offices (DIOs). The majority of the irrigation systems are, however, managed entirely by the farmers and are called Farmer-Managed Irrigation Systems (FMIS). Besides these two, there are irrigation systems which are jointly managed by the agency and the farmers; the head and main and secondary canal levels are usually managed by the agency and the tertiary and farm level are managed by the farmers and are called Joint-Managed Irrigation Systems. His Majesty's Government of Nepal (HMG/N) has clearly determined that its policy will be to decentralize irrigation management authority to local irrigation organizations (Eighth Plan, 1991:32-33). The policy proposed calls for irrigation system operations in these three modes.

In Nepal, the DOI has constructed, operated, and maintained many large irrigation systems covering service areas larger than 500 ha in the Hills and 2,000 ha in Terai. Continuation of this practice has, however, raised concerns over appropriate mobilization of scarce financial resources, records of unsatisfactory project performance, and indifferent behavior towards the completed projects by the user farmers.

At present the DOI is thought to be directly involved to some extent in the management of around 100 irrigation projects, from large to small scale although it completed 210 irrigation projects with an estimated irrigated area of 284,000 ha with an additional 30,000 ha of irrigated area developed by Farm Irrigation and Water Utilization Division of the Ministry of Agriculture ([Aryal 1992:9]). Pradhan estimated in 1988, that there were 1,700 farmer-managed irrigation systems in the Terai and 15,000 in the Hills which represent nearly 70 percent of the total irrigated area in Nepal ([P. Pradhan, 1988: 3]).

Policy and Institutional Environment

To examine the policy and institutional environment for irrigation development, it is necessary to lay out the irrigation development strategy of the government for the current eighth plan (1992-97) which is guided by four long-term objectives:

1. Increase agricultural production and benefits from irrigation land through a combination of agricultural and irrigation management programs;

2. Improve the delivery efficiency of irrigation related services, through institutional improvements within government agencies and the maximum possible of the private sector;

3. Implement small irrigation projects with improved procedures to identify, design and construct them, with active participation of beneficiary farmers in all the phases.

4. Select and implement new large and medium scale irrigation projects in the Terai, and in some of the river basins in the hills as a means of augmenting national agricultural production by significant amounts.

Thus, the government has put emphasis on: 1) the improvement of production from existing irrigated area through coordination of agricultural and water supply units; 2) improvement of institutional efficiency; and 3) implementation of small irrigation projects.

Even with all these strategies outlined, food production in Nepal is not yet sufficient to meet the needs of the total population, and, in particular, many hill areas are food deficit areas. Increased agricultural production can still be

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absorbed within the immediate neighboring area of production. The main reasons for these obstacles include: 1) The plans prepared for carrying out field activities are based on casual evaluations and appraisals of the situation and potential beneficiaries are not sufficiently involved in the process. 2) There is a lack of coordination among ministries related with natural resource management especially water resources and within the Ministry of Agriculture as well. 3) Inadequacy of facilities, equipment and supplies, as well as, well trained manpower constrained the effectiveness of irrigation improvement programs severely over the years. The field sub-overseer and the overseer are not trained to the level that they could handle the common field problems as they occurred. Furthermore, these technicians are spread too thinly over large geographical areas. 4) Material resources also were not available to the farmers to the required extent. Technical services were lacking in most of the rural areas which slowed down the pace of agricultural development. 5) Where new production enterprises were taken up, marketing facilities did not develop automatically. Also, a very limited effort was made to develop markets and this restricted agricultural development severely. 6) Agro-ecological zoning and identification of appropriate technological packages that are consistent with the enterprise opportunities available on the basis of comparative advantages are generally overlooked.

The combined effect of all these weaknesses has contributed to the slow growth in agricultural production. The farmers have inadequate confidence on the ability of the public sector to provide the necessary inputs and technical knowhow in time they want and in quantities they want.

Recent Changes in Irrigation Policy

Ministry of Water Resources of HMG/N (1992) has implemented new irrigation policy which outlines the government programs for different types of irrigation systems under different governance types. Although farmers (water users) are recognized as autonomous entities with legal power who have rights and duties of the water uses; full ownership of turnover systems; provision for joint management, and even the completed and handed over systems being the whole property of the users; the water is still regarded as the government property. The government has not given the full recognition of the prior use rights of the farmers and also the guarantee to the farmers that their systems will not be evicted for other competing water uses in the future.

A new Water Resource Act has been published in the Gazette in 1993 which addresses the issue of prioritization of hierarchy of water uses, privatization, incentives, licensing etc. A fundamental characteristics of the new Act is that the ownership of all water resources within the kingdom of Nepal is vested in the HMG and the government has the ultimate power to allow corporations, communities, or individuals to use the water resource. The hierarchy of water use as outlined in the Act is: i. drinking water and domestic use, ii. irrigation, iii. agricultural use such as fishery and animal husbandry, iv. hydroelectricity, cottage industry, industrial enterprises, and mining uses, v. navigation, vi. recreational uses, and vii. other uses.

The Act also gives full authority to the government to utilize or develop water resources as it sees fit. The Act also provides mechanism for conflict resolution through the arbitration of a prescribed committee. However, the district water resource committee as prescribed by the gazette comprises all the line agency officials at the district with Chief District Officer as the chairman and the Local Development Officer as the member secretary. There is only one representative member to be nominated by the District development Committee. Although the Act will not affect the day to day operations of the irrigation systems, the trend however, shows the basis of power is centralized rather than decentralized.

The current Eighth Plan (1992-1997) advocates locally available technologies and methods for community irrigation systems that are to be constructed and managed by the users themselves. Even in case of larger irrigation systems, they are to be demarcated into smaller units to be managed by the users. The Eighth Plan has stated the following objectives related to irrigation: i) increase agricultural production through the application of irrigation technologies appropriate to diverse climatic and soil conditions, and ii) provide irrigation facilities for maximum area of land by implementing economically, technically and environmentally sustainable projects with the participation of the farmers.

Regardless of the spirit and policy or legal provisions, the government still lacks the capacity to translate the policies into an effective enforceable system. Lack of intersectoral and interdepartmental coordination has also created a vacuum while addressing issues of interface such as: fisheries and irrigation; irrigation and drinking water; hydropower; irrigation and biodiversity. Importantly, the inability of the government to recognize the diverse local rules relating to rights and duties has worsened the implementation of the irrigation policy. (U. Pradhan, 1993) A variety of research has also suggested that the inadequate local participation in the process of governing and managing irrigation systems is a major reason for the ineffectiveness. Hence, enhancing farmers' participation has been a major component in many reform programs in developing countries which is the case for Nepal too.

Thus, the constraints which have adversely affected DOIs performance in the past and which continue to undermine its effectiveness include: inadequate capacity for policy and program planning, and attention to management skills; a structure and technical staff largely oriented towards construction; an inadequate career and reward system; inadequate

job specification and opportunities for specialization exacerbated by frequent and ad hoc transfers; lack of staff intake with training in agricultural engineering and irrigation, and O&M; and erratic generally inadequate budget for O&M. Virtually all these constraints confront the effective implementation of the new policies for participatory management and turnover.

Prescriptions for Management Transfer and Participation

The Irrigation Policy, 1992 has classified irrigation systems for the programs to be operated in accordance with the policy into four categories:

1. Systems operated by Water Users or to be operated by them in future.

2. Government irrigation systems to be turned over to Water Users Associations (WUAs).

3. Systems under the joint management of HMG/N and WUAs or irrigation sub-systems of multi-purpose projects.

4. Farmer-Managed Irrigation Systems or Private irrigation systems.

The majority of its provisions are directed mainly to 2) turnover systems, and to joint- management systems under 3) above. The policy further lays down that the full ownership of a turned over irrigation system lies with a WUA registered by HMG/N, which will be responsible for all Operation and maintenance (O&M). The policy also provides some basic provisions regarding the structure and responsibilities of WUAs under joint-management projects, but not for turnover projects.

DOI's Action Plan for the Turnover program has identified three types of schemes for turnover:

Type I	Schemes constructed by DOI, but at present managed by WUGs.
Type II	Schemes requiring organizational strengthening of the WUGs and minor improvements of infrastructure.
Type III	Schemes where essential structural improvements (ESI) are required in addition to institutional development of WUGs.

The objective of a Joint-Management Program according to HMG/N is "to share the system O&M responsibilities of large irrigation systems between WUOs and the Irrigation agency, and through training and strengthening of WUOs, to attract farmers to actively participate in the improvement of O&M of the sector entrusted to them."

The introduction of joint-management and turnover of AMIS has been carried out on an experimental basis in two selected projects, Sirsia-Dudhaura Irrigation System, joint-management, and Handetar turnover. Both of these systems could not be handed over to the farmers; and without further effort recently few other systems have been taken over by the DOI in anticipation of turnover and joint-management.

Institutional Framework for Turnover and Joint-Management Implementation

The basic organizational arrangement under which HMG/N's programs of joint management and turnover are to be implemented involve at central level, the Irrigation Management and Water Utilization Division (IMWUD) of the DOI, and the Research and Technology Transfer Branch (RTTB) and System Management Branch (SMB), with a Coordinator in charge of the two branches.

The Irrigation Management Project now under IMWUD started its intervention process in selected sites to help develop farmers' management capacities; and also to turnover the DOI systems to the farmers for their O&M. Malebagar Irrigation System, a FMIS in the Tanahu district was assisted for improving O&M of the system. Currently, IMP is working with the Water Users Group in Khageri and West Gandak AMISs to turnover these systems to the farmers. In order to improve the irrigation management practices of Nepali farmers, the Irrigation Management Project (IMP) under DOI has been in operation since 1987. Important objectives of IMP are: to create an awareness among government entities that management is the crucial link between construction of irrigation canal and production of farm crops that presently limit the benefits realized from government operated projects; and, to develop and strengthen the

capability of Water User Associations (WUAs) to assume greater responsibilities and authority for the O&M of irrigation systems. To achieve these objectives, the SMB and the RTTB are engaged in system O&M, essential structures development and WUAs formation and development.

The activities at the system level are implemented through the Regional Irrigation Directorates (RIDs) and the DIOs. The technical staff at district level together with Association Organizers (AOs) are the personnel responsible for joint-management and turnover programs. To guide AOs, manuals have been published by the RTTB both in English and Nepali language. However, arrangements for M&E and quality control are made on an ad hoc basis. Also the orientation of the technicians is still towards the physical construction and essential structures improvements rather than towards organizational and institutional development for the sustenance of the system.

IS PROVIDING PRESCRIPTION ENOUGH FOR MANAGEMENT TRANSFER?

The existence of a very large number of farmer-managed irrigation systems in Nepal where farmers themselves construct, govern, maintain and manage such a large number of irrigation systems has many things to offer in the management and governance of the agency-managed irrigation systems. Given the geographical setting of the systems, FMIS have been able to perform in agricultural productivity better than the AMIS (Laitos et al. 1986; [Pradhan 1989]; Shivakoti, 1992; Yoder 1986). The Nepal Irrigation Institutions and Systems (NIIS) database has now been established with information about 173 irrigation systems (see E. Ostrom Benjamin and Shivakoti 1992). The initial analysis based on this large number of irrigation systems has also found that FMIS perform more effectively in terms of agricultural productivity than AMIS.

The NIIS database now has substantial information about 127 Farmer-Managed Irrigation Systems (FMIS), and 46 systems that are either entirely governed and managed by the Department of Irrigation (DOI) which we call AMIS (a total of 19 systems) or where the headwork are operated by DOI and farmers have some day-to-day responsibility for managing lower canals; we now have classified these 27 systems as Joint-Managed Irrigation Systems (JMIS) (Table 1). We have also compared these attributes and values for different systems managed by farmers, agency or jointly managed. This gives an initial indication of the comparative systems attributes and performances among AMIS, FMIS and JMIS. In the later part of the analysis due to missing information, we have combined AMIS and JMIS in one category only as AMIS due to insufficient number of variables.

Table 1. Irrigation Systems in Different Terrain by Governance Type.

Type	Terrain				
	Hill River Valley	Hill	Terai River Valley	Teari	Total
Agency-Managed Irrigation Systems	5	4	2	8	19
Farmer-Managed Irrigation Systems	21	61	35	10	127
Loint-Managed Irrigation Systems	9	4	4	10	27
Total	35	69	41	28	173

Brief Overview of FMIS and AMIS in Different Terrains of Nepal

Most of the FMIS have received some form of external assistance at one time or another. Only 17 percent of the FMIS have not received any government or donor assistance. Government assistance has been extended to 26 percent and donor assistance has been extended to 57 percent. The amount of this assistance has varied widely from small grants that enable farmers to replace a wooden aqueduct with a PBC pipe all the way to the construction or rehabilitation of an entire system.

The average service area of AMIS is 939 ha, while FMIS average about one-third of that size -- 273 ha. The variability among FMIS is higher than the variability among AMIS in regard to the amount of land served by the these systems. There is also a substantial difference between the average size of the systems in the Hills and those in the Terai. The AMIS in the Terai have an average area of 2,089 ha whereas the AMIS systems in the Hills average only

192 ha. But FMIS are substantially smaller systems on the average than AMIS in all terrains. In the Hills and Hills-River-Valleys, FMIS are about one-fourth the size of AMIS systems.

In Nepal, labor is mobilized for routine cleaning of the canals and repairing of the intake. This usually occurs during the driest part of the year in preparation for the monsoon season. Some routine maintenance is continued on a regular basis throughout the year. Emergency repairs of the intake or main canal can occur at any time. The rules that relate to emergency repair are usually different than the rules used for routine maintenance. Many systems require all irrigators to be present for a large emergency repair. Labor can be mobilized for routine maintenance based on any of the following: 1) the amount of land owned, 2) the quantity of water received, 3) according to family or kin rights and duties, 4) every household sending an equal number of workers, 5) every household sending whomever they want on a labor day, and 6) a variety of other rules. In Nepal, most systems rely on the amount of land irrigated as the basis for *routine* labor mobilization. Fifty nine percent of the FMIS and 47 percent of the AMIS mobilize labor for routine maintenance on the basis of land. Around one-third of both AMIS and FMIS require equal participation of each household as the basis for this labor mobilization.

The average number of households in these systems is 431 in the FMIS whereas it averages 1328 in the AMIS. Systems serve on the average a smaller number of households in the Hills (FMIS - 112, AMIS - 335), than in the Hills-River-Valley (FMIS - 168, AMIS - 1402), or in the Terai (FMIS - 829, AMIS - 2104). The variation in size measured by a standard deviation is substantial across all types of systems and terrains.

Agency-managed irrigation systems have, on average, recorded 5.1 tons per ha of production of major cereals while the FMIS have recorded an average of 5.9 tons per ha of output in a year. The higher productivity of FMIS as contrasted to AMIS is even stronger when one controls for terrain. The highest average yields obtained in any terrain were those of FMIS in the Hills-River-Valleys of Nepal (6.8 metric tons). The lowest recorded average yields were obtained in the AMIS located in the Hills (4.5 metric tons).

Average cropping intensities at the head are higher in the FMIS than those in the AMIS based on data from 118 systems. On average, FMIS had a cropping intensity at the headend of systems of 246.2 percent (or the equivalent of two seasons of full cropping and a third season of half cropping) and the AMIS had a cropping intensity at the headend of systems of 208.3% (or the equivalent of two seasons of full cropping and a third season with about an 8 percent of the tail end planted). FMIS in the Terai achieved the highest headend cropping intensities -- over 250%. FMIS in the Hills came very close to matching this level at least in the headends.

The labor days required for the annual repair and maintenance average nearly 1,000 man days for an average system area of 841 ha which is slightly more than one day of labor contribution per ha of irrigated land. If we compare the number of labor days required for repair and maintenance, nearly two-thirds of the FMIS have required lower number of labor days as opposed to for half of the AMIS and JMIS (Table 2).

Table 2. Labor Days Required for Repair and Maintenance of Irrigation Systems by Governance Type.

Governance Type	Number of Labor Days Required
Agency-Managed Irrigation Systems	903 (N=15) [1551] Below Mean=9 Above Mean=6
Farmer-Managed Irrigation Systems	931 (N=102) [1835] Below Mean=66 Above Mean=36
Joint-Managed Irrigation Systems	1455 (N=19) [2177] Below Mean=8 Above Mean=11
All Systems	1001 (N=136) [1853]

Note: Figures in the square brackets are Standard Deviation.

In comparison of average productivity, 5.2 metric tons of cereals per ha per year by governance type which shows higher productivity in the majority of FMIS than in the AMIS and JMIS (Table 3).

The average cropping intensities at the head and tail ends for all systems in the NIIS database are 237% and 226%, respectively. These comparisons have shown that the average cropping intensities of the FMIS are higher than those of AMIS and JMIS (Table 4).

Water adequacy during dry and monsoon periods ranges from abundant to limited in the majority of the FMIS whereas even during the monsoon seasons, water availability in the majority of JMIS and AMIS is limited or scarce (Table 5).

Table 3. Irrigation Systems Productivity by Governance Type.

Governance Type	Productivity (Mt/ha)
Agency-Managed Irrigation Systems	4.94 (N=18)
Farmer-Managed Irrigation Systems	5.56 (N=98)
Joint-Managed Irrigation Systems	4.29 (N=27)
All systems	5.26 (N=140)

Table 4. Head and Tailend Cropping Intensity by Type of Governance.

Governance Type	Cropping Intensity Head	Tailend
Agency-Managed Irrigation Systems	195% (N=17) [51.9]	177% (N=17) [44.5]
Farmer-Managed Irrigation Systems	248% (N=120) [45.2]	238% (N=119) [47.2]
Joint-Managed Irrigation Systems	216% (N=27) [60.7]	202% (N=25) [66.7]
All Systems	237% (N=164) [51.8]	226% (N=161) [54.4]

Note: Numbers in square brackets are Standard Deviation.

Table 5. Water Adequacy by Type of Governance Arrangement and Season.

Season of Year	% of AMIS with Adequate Water		% of FMIS with Adequate Water		% of JMIS with Adequate Water	
	Head	Tail	Head	Tail	Head	Tail
Monsoon	89	63	91	78	78	32
Winter	48	11	37	34	33	08
Spring	26	11	36	23	04	0

Many of the FMIS in Nepal lack permanent headworks and lining and are at least partially lined. The design and engineering of the FMIS were undertaken by local farmers or by members of the specialized castes who had inherited their skills through parents and grand parents. The design and engineering of the AMIS are done by trained and skilled engineers. Even then we have seen from the sample of large number of irrigation systems that FMIS are persistently performing better than AMIS. Many questions arise from these findings. Why are FMIS performing better than AMIS although the government has put a lot more resources on the construction and supervision? What will happen when there is public intervention in FMIS? What can be learned from FMIS experiences for future turnover and management transfer of AMIS? In an attempt to answer these questions, based on the measurement model for evaluating the performance of irrigation systems developed by Lam (1992), three dimension of irrigation performance are as follows:

1. Physical — The conditions of the physical system itself (e.g., how well are the irrigation canals?).

2. Delivery — The distribution of water to farmers (how adequate is the water to the head and tail of systems across agricultural seasons?).

3. Productivity — The agricultural productivity of the system.

To better analyze how physical attributes of irrigation systems, such as head works and lining, interact with various institutional variables which in turn affect system performance Lam, Lee and Ostrom (1993) have classified systems into three groups of physical environment: Group 1--systems without lining or permanent head works; Group 2--systems with partial lining but without permanent headworks; and Group 3-- systems with permanent headworks (Table 6). We have data for about 125 systems in which all of the Group 1 systems in the NIIS database--without permanent headwork and lining--are FMIS. Almost 9 out of 10 of the Group 2 are also FMIS. Group 3--with permanent headwork--on the other hand 80 percent of the AMIS have permanent headwork. On the other hand only 28 percent of the total FMIS have permanent headwork.

Table 6. Proportion of FMIS and AMIS With Different Physical Attributes.

Group	Agency-Managed Irrigation Systems	Farmer-Managed Irrigation Systems	Total
Group 1: Systems Without Lining & Without Permanent Headworks	0% (N=0)	100% (N=37)	100% (N=37)
Group 2: Systems With Partial Lining & Without Permanent Headworks	12% (N=5)	88% (N=36)	100% (N=41)
Group 3: Systems With Permanent Headworks	38% (N=18)	62% (N=29)	100% (N=47)
Total	18% (N=23)	82% (N=102)	100% (N=125)

NIIS database contains data about productivity for 88 of the systems which have been dichotomized to measure agricultural productivity at the mean to create two values: "above average productivity" and "below average productivity." Nearly two-thirds of the systems without lining and without permanent headwork have above average productivity, and most of these systems are FMIS (Table 7). Of those with partial lining, 27 out of 32 are FMIS. In case of systems with permanent headwork there are only 6 systems out of 31 whose agricultural performance is above average. Thus, it is hard for any variable to affect the basic relationship between permanent headworks and below average performance.

Table 7. Relationship Between Physical Type and Dichotomized Productivity Measure

Group	Systems Lower Than Mean Agricultural Productivity	Systems Higher Than Mean Agricultural Productivity	Total
Group 1: Systems Without Lining & Without Permanent Headworks	36% (N=9)	64% (N=16)	100% (N=25)
Group 2: Systems With Partial Lining & Without Permanent Headworks	47% (N=15)	53% (N=17)	100% (N=32)
Group 3: Systems With Permanent Headworks	78% (N=25)	22% (N=6)	100% (N=31)
Total	(N=23)	(N=102)	(N=125)

Although much of the effort of DOI has been in the improvement of physical structure and has ignored the institutional development of AMIS and so-called JMIS, the findings from the analysis of NIIS data suggest that institutions [matter] due to higher agricultural productivity obtained by most of the FMIS as compared to AMIS and JMIS. Thus, it is necessary to think about investing major capital in engineering without matching for their environment because these activities have detracted from the capability of the farmers to devise effective institutional setting to enhance performance.

CONCLUSIONS AND POLICY IMPLICATIONS

The transfer of Nepal's public sector irrigation systems to water users' organization for operation and management is based on current irrigation development policy of the government which seeks users participation at all levels of irrigation development from project identification, design and construction to operation and management. Based on this program several government managed irrigation systems are in the process of turnover to water users organizations. The government aims at transferring the management of small and medium irrigation systems to the users with the service area of nearly 100,000 ha (which is nearly one-third of total AMIS) by the year 2000 A.D. There are, however, no clear cut policies available to guide the turnover process. Several issues originate from the turnover process which, among others, are: whom to turnover, what part of the system, what size of the system, what legal provisions for turnover, what role of the government.

Recent changes in irrigation policy and new Water Resource Act have to some extent clarified many confusions on the management transfer of the AMIS to the FMIS. The policy provides basic provisions regarding the structures and responsibilities of WUAs under joint-management projects, but not for turnover projects. Similarly there is no clear cut distinction made on the responsibility of DOI on the joint-managed irrigation systems although the policy lays down that the full ownership of a turned over system lies with a WUA registered by HMG/N. Thus, there is further need to lay out the clear cut roles and responsibilities of DOI and the WUAs.

The role of RTTB and SMB are very crucial in determining the process of turnover both in terms of building the capacity of the field level staff and in documenting the management experiences of FMIS which can be applied to the management transfer of AMIS. Any irrigation system for its effective management and high performance needs institutional support for its viability and sustainability. Management transfer is not the same as shifting of responsibility. Due to the heavy investment nature of AMIS, whether the systems remain under the joint-management or the turnover programs, farmers need continuous support in various degrees. Thus, the role of government is equally important in providing the support beyond the capacity of the farmers and also in protecting the interest of farmers. Thus, there is need of shift in the policy of government from that of protector to that of facilitator. The clear DOI policy for joint-

management should only be undertaken if DOI can do a better job of delivering water to a point in an irrigation system than the farmers. Similarly, the policy of turnover must not be turnover and forget, but must be turnover and serve.

In the process of collecting information from both agency managed irrigation systems (AMIS) and farmer managed irrigation systems (FMIS) in Nepal Irrigation Institutions and Systems (NIIS) database, a preliminary information suggests that FMIS have successful physical, institutional and agricultural performance than those of AMIS. [The fact that very little attention has been paid by the agency personnel to the temptation that farmers face to ignore one another's interests, and how technology and institutions might enhance or detract from the capacity of farmers to seek better distribution pattern of their water.] In a system where expensive headworks have been constructed by outsiders and farmers have little need to mobilize resources for O&M, tailend farmers do not have much bargaining power with headenders. This will create wasteful use of water by headenders, and tailenders may not get any which will result in the lower productivity in the system as a whole. Under such circumstances, tailenders will refuse to pay water fee unless they receive adequate water. On the other hand FMIS which have no major technological interventions are extremely well-organized and disciplined due to their ability to build on strong institutions by developing rules suitable to their environment.

DOI has required organization in the system as qualifier for the improvement/rehabilitation of the systems. Many informal organizations have formalized themselves . But by just creating standard organizations throughout the country without sufficient training backups suitable to the local conditions, these organizations will remain dysfunctional. To help these organizations function better, the role of RTTB and SMB is crucial and these institutes need further strengthening and also an effective functional role with the DIOs. The documentation of diverse rules, roles and behavior of functionaries present in the particular environment is extremely important including customary practices and rules. This must be fed into the irrigation policy and Acts so that these diversities are maintained. The NIIS database has documented diverse rules matched to the local condition, and in turn the systems function better.

The role of government is crucial for the improvement of local level support services especially related to providing the congenial atmosphere as a promoter and facilitator of the farmer needs for improved farming practices. Providing services only to rehabilitate/improve physical condition of the irrigation system alone is not sufficient. Thus, in addition to providing physical improvement support, institutional and legal frame-work to increase the productivity support services is crucial to improve the standard of living of the users residing in the area since irrigation is only one of the many factors in increasing productivity.

References

[Benjamin, P. 1992. "Historical Basis of Irrigation in Nepal" in Ostrom, E., P. Benjamin, and G. Shivakoti ed. Institutions, Incentives and Irrigation in Nepal. Bloomington, Indiana University, Workshop in Political Theory and Policy Analysis.]

[HMG/N, Ministry of Water Resources, Department of Irrigation. 1989. Master Plan for Irrigation Development in Nepal. Cycle 1, Main Report. Canadian International Water and Energy Consultants in association with East Consult (P) Ltd.]

HMG/N, National Planning Commission. 1991. Eighth Five Year Plan. Singh Durbar: Kathmandu, Nepal.

HMG/N, Ministry of Water Resources. 1992. Irrigation Policy: 1992. Singh Durbar, Kathmandu.

MHG/N, Ministry of Water Resources. 1992. Water Resources Act, 2049. Singh Durbar, Kathmandu. (unofficial translation)

[HMG/N, Ministry of Water Resources. 1993. Irrigation Management Transfer Project. Draft Final Report. Kathmandu, Nepal.]

[IMSSG/IAAS. 1994. Nepal Irrigation Institutions and Systems: Resource Inventory and Process Documentation. Progress Report submitted to Ford Foundation. Irrigation Management Systems Study Group, Institute of Agriculture and Animal Science, Rampur, Chitwan, Nepal.]

Laitos, Robby, et al. 1986. Rapid Appraisal of Nepal Irrigation Systems. Water Management Synthsis Report No. 43. Fort Collins: Colorado State University.

Lam, Wai Fung. 1992. "Measuring Performance: Issues and Puzzles." Technical Report. Bloomington: Indiana University, Workshop in Political Theory and Policy Analysis.

Lam, W.F., Myungsuk Lee, and Elinor Ostrom. 1993. "An Institutional Analysis Approach: Findings from the Nepal Irrigation Institutions and Systems (NIIS) on Irrigation Performance." Paper presented at the workshop "From Farmers' Fields to Data Fields and Back: A Synthesis of Participatory Approaches to Resource Information System" held at the Institute of Agriculture and Animal Science, Rampur, Chitwan. March 21-26, 1993.

[Ostrom, Elinor. 1992. Crafting Institutions for Self-Governing Irrigation Systems. San Francisco, Calif.: Institute for Contemporary Studies Press.]

Ostrom, Elinor, Paul Benjamin, and Ganesh Shivakoti. 1992. Institutions, Incentives, and Irrigation in Nepal.Volume 1, Bloomington, Indiana University, Workshop in Political Theory and Policy Analysis.

[Poudel, S.N. 1992. Irrigation Profile of Nepal. Research and Training Branch, Department of Irrigation, Kathmandu, Nepal.]

Pradhan, P. 1989(a). Pattern of Irrigation Organization in Nepal: A Comparative Study of 21 Farmer-Managed Irrigation Systems. International Irrigation Management Institute, Colombo, Sri Lanka.

[_____ 1989(b). Increasing Agricultural Production in Nepal: Role of Low-cost Irrigation Development Through Farmer Participation. Colombo, Sri Lanka: International Irrigation Management Institute.]

[Pradhan, Ujjwal. 1993. "Farmers' Water Rights and Their Relation to Data Collection and Management." Paper presented at the workshop "From Farmers' Fields to Data Fields and Back: A Synthesis of Participatory Approaches to Resource Information System" held at the Institute of Agriculture and Animal Science, Rampur, Chitwan. March 21-26, 1993.]

Shivakoti, Ganesh. 1992. Variation in Interventions, Variation in Results: Assistance to FMIS in Nepal. Irrigation Management Network Paper 11. Overseas Development Institute. London.

Yoder, Robert, P. 1986. "Farmer-Managed Irrigation Systems in the Hills of Nepal." Ph.D. diss., Cornell University.

Acronyms

ADB	Asian Development Bank
ADB/N	Agricultural Development Bank of Nepal
AIC	Agricultural Input Corporation
AMIS	Agency-Managed Irrigation System
AO	Association Organizer
DIO	District Irrigation Office
DOA	Department of Agriculture
DOI	Department of Irrigation
ESI	Essential Structure Improvement
FIWUD	Farm Irrigation and Water Utilization Division of Department of Agriculture
FMIS	Farmer-Managed Irrigation System
HMG/N	His Majesty's Government of Nepal
IIMI	International Irrigation Management Institute
ILC	Irrigation Line of Credit
IMP	Irrigation Management Project
IMWUD	Irrigation Management and Water Utilization Division
ISP	Irrigation Sector Program
JMIS	Joint-Managed Irrigation System
MOA	Ministry of Agriculture
MOWR	Ministry of Water Resources
NIIS	Nepal Irrigation Institutions and Systems
O&M	Operation and Maintenance
RID	Regional Irrigation Directorate
RTTB	Research and Technology Transfer Branch of Department of Irrigation
SMB	System Management Branch of Department of Irrigation
SSP	Support Service Programs
VDC	Village Development Committee
WUA/O	Water Users Association/Organization
WUG	Water User Group