

PROBLEMS, PROSPECTS, AND OPPORTUNITIES IN DEVELOPING FARMER-MANAGED IRRIGATION SYSTEMS IN NEPAL: THE DEPARTMENT OF AGRICULTURE'S FARM IRRIGATION PROGRAM

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INTRODUCTION

Agriculture is a strategic sector in the Nepali economy engaging almost 94 percent of the population and making up almost two-thirds of the annual Gross Domestic Product (GDP). However, the current decline in agricultural productivity against an accelerated population growth is leading to an imbalance between food supply and demand. To reverse the trend, cereal production must at least double the present level by the year 2000.

To achieve this, attempts are being made to raise crop yields under rainfed conditions. However, at best, rainfed agriculture can achieve only a fraction of the productivity of irrigated areas. Nepal must develop irrigation to obtain maximum grain production. Presently, using local practices, irrigated rice yields about 3.0-3.75 metric tons/hectare (t/ha). Provided there is timely irrigation, production can be increased to over 4.5 t/ha if farmers adopt improved cultivation practices and apply recommended doses of fertilizer and related inputs. Because the lack of sufficient water is one of the main constraints to increased production, using each unit of water with maximum productivity should be the aim.

GOVERNMENT AGENCIES INVOLVED IN IRRIGATION DEVELOPMENT AND THEIR APPROACHES

Department of Irrigation, Hydrology and Meteorology (DIHM)

DIHM, under the Ministry of Water Resources, is the principal organization involved in irrigation development in Nepal. Functions presently carried out by DIHM include: investigation, design, construction, rehabilitation, and operation and maintenance (O&M). DIHM undertakes projects with command areas larger than 500 ha in the Tarai and larger than 50 ha in the hills. At the regional level, the functions and responsibilities of DIHM are carried out through five directorates.

Project Board Management

Some of the larger projects are carried out through semi-autonomous organizations called "project boards." Separate project boards function for some donor-assisted irrigation projects under the Development Board Act of 1956. Management under this

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system gives autonomy in personnel recruitment and financial flexibility. The composition and practices of the individual project boards, variously described as autonomous or semi-autonomous, are virtually all the same. Each board is formed with representatives from the ministries of Finance, Agriculture, and Land Reform, and is chaired by the Secretary of the Ministry of Water Resources. One representative each from the National Planning Commission, Department of Agriculture, and DIHM is also included as a member of the Board. The General Manager/Project Manager/Project Engineer works as a member-cum-secretary of the Board. In certain cases Regional Directors of Agriculture and Irrigation are also included as members. It is said that the Board represents the symbol of cooperation at the highest level.

Ministry of Panchayat and Local Development (MPLD)

This Ministry is responsible for various local development works including: village water supplies, construction of small bridges, upkeep of tracks and trails, maintenance of *panchayat*¹ buildings, and assistance to small irrigation schemes.

In 1970, the Department of Minor Irrigation was established and the responsibility for the implementation of minor irrigation was given to the chairman of the district panchayat. Due to the lack of professional manpower at the district level, it was merged into the Irrigation Department in 1971. The Irrigation Department then took the responsibility of managing irrigation systems with command areas over 50 ha. Irrigation schemes serving less than 50 ha were given to the MPLD. Technicians are appointed by the MPLD to the District Technical Office which is responsible to the Local Development Officer for implementing local development works at the village level.

Agricultural Development Bank of Nepal (ADBN)

ADBN, which is mainly responsible for providing credit to farmers for agricultural activities, finances irrigation schemes. It grants loans for three types of irrigation development programs: 1) the Farm Irrigation and Water Utilization Division's (FIWUD) irrigation schemes, 2) pump irrigation, and 3) gravity irrigation systems. Although ADBN investment in irrigation started in 1968, the intensive irrigation program under ADBN began in 1981.

Over 11,000 shallow tube wells have been installed under this loan program making irrigation facilities available on more than 45,000 ha. The loans are given primarily to individual farmers for pump-sets and related materials and are to be paid back in seven years. The government provides a labor subsidy of up to NRs 3000 (US\$150) for installation. O&M costs are paid by the pump-owner. ADBN has collaborated with CARE to finance a few gravity irrigation systems. CARE provides 50 percent of the total cost, farmers take 30 percent as a loan, and provide 20 percent as labor or cash. Implementation has not reached the target level due to problems with group formation and high staff turnover where there are alternative employment opportunities in less remote areas. The estimated cost of such schemes is US\$800-900 per ha (in 1984 prices).

Farm Irrigation and Water Utilization Division (FIWUD)

The Ministry of Agriculture, through FIWUD, is responsible for farm level irrigation development and water management. FIWUD was established in 1973 under the Department of Agriculture to bridge the gap between the engineering services of the DIHM and the extension services of the Department of Agriculture in public and farmer-managed irrigation systems across the country. Most of FIWUD's technicians are agricultural engineers with some knowledge of basic agriculture.

FIWUD's mandate is to: 1) provide irrigation and drainage facilities at the farm and the field level to ensure the optimum amount of water, 2) assist in operating tertiary irrigation systems in large- and medium-scale projects, 3) organize water user groups and guide and monitor their activities, 4) provide training to water users in tertiary system O&M and on-farm water management, and 5) develop ways of increasing cropping intensity through coordination with agricultural research and extension services and through the introduction of new irrigation technology.

At present, FIWUD is working under two types of programs, the Water Utilization Program, and the Farm Irrigation or Small Irrigation Program.

Water Utilization Program. The Water Utilization Program concentrates on large- and medium-scale public irrigation projects. This covers gravity and deep tube well systems in the Tarai areas. In this program, structures like dams, main and secondary canals, and deep tube wells are constructed by DIHM. It has been found that many require additional conveyance and control structures for better water management. In addition to building the necessary lower level control structures, this program assists with land improvement and other measures for increasing the cropping intensity and efficient water utilization.

The work is carried out by forming water user groups which are informal voluntary organizations without legal authority. The maintenance of the field channels is the responsibility of these water user groups. However, operation of the system and maintenance of the control structures and larger channels are done by DIHM. In the Water Utilization Program, farmers' involvement begins in the middle stage of project implementation rather than in the project formulation stage.

Farm Irrigation or Small Irrigation Program. The aim of the Farm Irrigation Program of FIWUD is to help farmers in constructing, improving, and maintaining their own irrigation systems, and to make optimum use of the available water for increasing production by using simple technology. The beneficiaries are involved in all stages of planning and implementation. Attempts are made to incorporate their ideas and experience without killing their self-help attitude. FIWUD has developed a "high farmer participation concept." This approach is most suitable to small systems. By mid-1986, FIWUD completed 106 projects in the hills and Tarai covering approximately 19,600 ha. There are 81 projects in different stages of construction and feasibility studies of another 105 projects have been completed. Table 1 gives a breakdown of completed and ongoing work. FIWUD now has over 25 senior

engineers and agriculturalists and over 40 overseers and technicians on its staff. The estimated cost of FIWUD schemes is NRs 4,000-5,000/ha (US\$190-238/ha) in 1984/85 prices.

Table 1. Frequencies by district of irrigation schemes completed (COM), under construction (UC), and surveyed (SUR) by the Farm Irrigation and Water Utilization Division (FIWUD), Department of Agriculture, Nepal.

Zone	District	COM	UC	SUR	Zone	District	COM	UC	SUR
Janakpur	Ramechhap	12	11	5	Seti	Baitadi	-	3	-
	Sindhuli	10	13	2		Achham	-	1	1
	Dolkha	2	-	-		Kailali	2	-	1
	Mahottari	1	-	-		Kanchanpur	1	-	-
	Dhanusa	32	10	1		Doti	-	1	1
	Sarlahi	-	2	-		Bhajangng	-	-	1
Dhaulagiri	Parbat	6	-	3	Narayani	Makwanpur	-	-	2
	Baglung	1	1	4		Persa	2	-	3
	Myagdi	2	1	-		Rauthat	1	-	4
	Gulmi	-	-	-		Chitwan	3	-	8
Koshi	Terthum	3	2	4	Rapti	Rukum	-	5	3
	Dhankuta	-	2	1		Salyan	-	1	6
	Bhojpur	1	1	1		Dang	-	1	-
	Sankhuwasava	-	-	1		Jajarkot	3	-	6
	Sunsari	2	-	1		Kalikot	2	-	-
	Jhapa	1	1	-		Rolpa	-	-	4
	Morang	-	-	1	Dolpa	-	-	1	
	Taplejung	-	-	1	Bagmati	Nuwakot	3	5	9
	Panchthar	2	-	-		Dhading	2	2	5
Sagarmatha	Khotang	3	3	4	Sindhupalchowk	1	-	-	
	Okhaldhunga	-	1	3	Kavere	1	2	-	
	Sirha	1	-	2	Rasuwa	-	1	-	
	Sofukhumbu	-	-	1	Bhaktapur	1	-	-	
	Udaipur	-	-	4	Kathmandu	1	-	2	
	Saptari	-	-	2	Lalitpur	1	1	2	
Lumbini	Palpa	-	4	2					
	Arghakhachi	-	1	1					
	Rupendehi	2	3	3					
	Kapilbasstu	1	-	-					
Total							106	81	105

As a part of the strategy, improvements of existing irrigation schemes are jointly financed by the government and the beneficiaries. Of the total estimated cost, 75 percent is contributed by the government as a grant for materials and construction of structures, while the remaining 25 percent comes from the farmers. The farmer's contribution is proportional

to the land owned by each farm family in the command area. To qualify for new construction or improvements in an existing system, 5 percent of estimated costs must be paid in cash.

The beneficiaries must form a construction committee. This committee consists of five to seven members with the ward chairman and *pradhan panch* (village headman) as ex-officio members. The construction committee determines the proportion of each beneficiaries' contribution to the construction of the project. The 5 percent cash contribution must be paid into a bank account before work can be started and must be supported by a formal declaration by the committee to take responsibility for construction and future O&M. The rest of the farmer's contribution can be either in cash, as a loan from ADBN, or in the form of free labor.

An account is opened in ADBN in the name of the scheme, and the 5 percent cash raised by the beneficiaries is deposited. The account is handled by the joint signatures of the representative of the construction committee and the FIWUD officer-in-charge of the scheme. Funds are withdrawn to purchase materials and equipment and to pay contract labor for specialized work. Records of expenditure are kept for accounting purposes. Under this arrangement, the farmers' construction committee itself purchases and transports the construction materials to the site and thus by-passes the cumbersome and time-consuming contractual and competitive bidding formalities.

Besides providing 75 percent of the costs of the total scheme, FIWUD's contribution consists of technical assistance in identifying and evaluating the system, designing structural works, supervising and managing construction, and providing any specialized labor that is required.

The farmers contribute local resources, including haulage to the site and labor for the improvement or construction of the distribution system. The construction committee is renamed the water user group after construction is completed, and is responsible for allocating irrigation water among the beneficiaries, and for system O&M. FIWUD strengthens the water users group by giving training in system O&M and on-farm water management.

After completing construction or improvements, FIWUD's field staff initiate the Water Utilization Program with the help of the Agriculture Development Officer and staff from other line agencies working in the field. Further involvement of FIWUD is limited to monitoring and evaluating the system in order to improve the design of future systems, and giving advice on maintenance and water management at the request of the water users group.

The FIWUD small irrigation program was implemented five years ago. At the start of each new fiscal year, FIWUD staff from all the Zonal Offices have a general meeting at the central office in Kathmandu to discuss their experiences and problems. This is an opportunity to find solutions to problems and to establish a new strategy for the smooth

operation of the program. For example, after the government introduced the Decentralization Act, modifications were made in the way the program was implemented. The details of the implementation procedure are given in the following sections.

Project identification. The first step is the identification of viable small irrigation schemes. The request for assistance for irrigation may come in writing through the ward concerned, village panchayat, district panchayat, or another agency to the District Agriculture-Irrigation Committee.² When an application comes to a zonal office or directly to FIWUD, it is immediately forwarded to the District Agriculture-Irrigation Committee for necessary action. This committee forwards the application to the Zonal Farm Irrigation Office with the recommendation of the district assembly, or to the District Panchayat. This is usually done once each year. Based on the list of applications received, inventories are prepared for further action by the Zonal Farm Irrigation Office. The project identification work is scheduled a year ahead of its implementation.

The initial application originates from the beneficiaries. It must contain the necessary information to enable the concerned authorities to determine the feasibility of the scheme. Applications contain precise information on the following points: a) signature of all the beneficiaries; b) brief description of the command area; c) present and future cropping pattern; d) description of water resources; e) distance of water source from the command area; f) area to be irrigated; g) number of households to benefit; and h) village panchayat, ward number, etc.

Site survey. A FIWUD topographic survey team goes to the area and arranges a meeting with the beneficiaries. The technicians explain in detail all the procedures for the implementation of a scheme. A working committee of six or seven members is formed and one member of the committee is selected as chairman. Sometimes the chairman is elected by a raised-hand vote and usually the decision is unanimous.

Farmers are asked to accompany the technician in the survey and walk along the canal alignment. This activity provides information about the area and irrigation sources as well as an opportunity to discuss advantages and disadvantages of alternative canal locations. In this stage the team identifies the prospective beneficiaries and completes a questionnaire of the preliminary investigation, which includes details about the existing crops, soil, land, water resources to be tapped, availability of construction materials, and other physical and social information. It also includes a declaration by the beneficiaries of a commitment to the procedures of FIWUD.

Based on their experience and the guidelines provided by FIWUD, the survey team can usually determine the feasibility of the proposed scheme from the preliminary investigation. If the team decides that the project is feasible, it conducts a detailed survey to be used in design. If it is obvious that the project is not feasible, they leave the site after doing only the preliminary survey, without giving any promises to the farmers.

Design and estimation. After the field survey is complete, the design work is done at the Zonal Farm Irrigation Office. For the design to be approved, the following minimum list of

items must be submitted: a) salient features of the scheme; b) details of the intake and site plan; c) detail profile of the canal alignment with types of structures shown on it; d) drawings with structural details; e) if possible, the elevation of the intake and the highest point of the command area; f) application from the beneficiaries and their recommendation; g) preliminary investigation report; h) rate analysis as well as the District Panchayat's rate analysis; i) bill of quantities and cost estimate; and j) benefit/cost ratio and any recommendation by the survey team.

Criteria for approving the schemes. Although the benefit/cost ratio is the major criterion for approving the schemes, three more factors are also considered: a) length of canal and number of crossing and other structures, b) total cost of the scheme, and c) cost per hectare.

Approval, notification, and formation of construction committee. After approval of the scheme, a letter of notification of the feasibility of the scheme is sent to the community concerned.³ An estimate of the cost is included along with instructions for the necessary actions that the beneficiaries must take which include: a) forming a construction committee, b) depositing 5 percent of the estimated cost in an account with ADBN in the name of the scheme, and c) formal signing of the agreement form by the construction committee members signifying their acceptance of the FIWUD procedure for implementation of the scheme.

FIWUD procedure for implementation. After the construction committee is formed, it is the responsibility of the committee to send a letter through the panchayat office to the Zonal Farm Irrigation Office. The signature of all the members of the construction committee must be on the letter. As necessary, the FIWUD staff helps to organize the construction committee and to arrange a loan through ADBN.

If the construction committee is not formed and/or their commitment is not forthcoming, the project is not implemented. FIWUD requests a statement as to why the community does not want to go forward with the project and forwards the statement to the district panchayat, who can intervene at this stage to try and clear up any misunderstandings. In the event of the cancellation of a scheme, a new scheme is selected from the contingency list prepared during the survey and identification of projects.

Implementation of the scheme is carried out by the construction committee. The FIWUD engineer is responsible for providing technical support, supervision, and advice to the committee. He also supplies information about availability of material and equipment.

The construction committee records the minutes of meetings in a register that they call their minute book. They also record work awards to local people, details of hiring and contracting labor for special work, resolution of disputes in the alignment of the canal, expenditures for material procurement, labor payments, and all other decisions of the committee. This book is open to whoever wishes to check any information.

The FIWUD engineer measures and records the progress of the construction work in a separate book that he maintains. All of the work done is entered into the measurement book at intervals of about 15 days. Payment is made according to the approved estimate even if the work completed is greater than the estimate. The work completed above the estimate is considered a part of the voluntary contribution. The construction work is awarded by the committee to various beneficiaries, preferably as piecework.

After completion of the scheme, an inspection and final approval is made by FIWUD upon receiving a written request from the construction committee. A certified copy of the expenditure accounts, along with all the documents, is forwarded to the zonal office by the construction committee for the Zonal Farm Irrigation Office records.

Formation of the water users group. As soon as the construction is over, the FIWUD technicians inform the construction committee that it should convert itself into a water users group to take care of future operation and maintenance. This is according to the FIWUD rules that are agreed to by all beneficiaries before starting the project. One amendment that is made to the composition of the construction committee when it becomes a water users group, is to increase the number of members.

The beneficiaries may decide to raise funds for future repair and maintenance work. This money can be kept in the ADBN account. The regular repair and maintenance of the scheme is carried out by water users groups with technical assistance from the Zonal Farm Irrigation Office. Neither water taxes nor other irrigation fees are collected by the government in these projects.

ISSUES STEMMING FROM FIWUD-SUPPORTED IRRIGATION DEVELOPMENT

Project Selection

The political influence in project selection and implementation is minimized by setting strong selection criteria. In the early days of this project, much political pressure was experienced by FIWUD. But on the basis of experience and by using technical reasoning supported by actual field data, FIWUD developed appropriate criteria. Now projects presented for consideration must be recommended by the district panchayat or district assembly. Final approval is then made by FIWUD.

Formation of the Construction Committee

In most of the FIWUD schemes the construction committee is formed smoothly by the beneficiaries without complaints, but there is competition for the post of chairman. In such cases, the chairman frequently finds it difficult to remain in his post when he encounters problems. In some instances he has been forced to leave the post because of misdeeds. If the beneficiaries decide that the chairman is working against their benefit, they force him to resign. This happened in one of the projects of Ramechhap where the chairman wanted to divert money from FIWUD as an advance for other work awarded to him by contract

a few years earlier. Similarly, in one of the schemes of Kalikot district, the chairman (ex-pradhan panch) was forcibly changed by the beneficiaries when he wanted to exploit the laborers.

Depositing Five Percent of the Cost Estimate in ADBN

In most cases the compulsory 5 percent deposit comes from the beneficiaries, but in some cases only a few people or a single person deposit the total amount on behalf of everyone. If all contribute to the deposit, the work progresses much faster than if only one or a few do so. Concern about the use of the money they have deposited encourages the beneficiaries to participate in implementing the scheme. The requirement of a cash deposit is a good tool for sorting out projects that need help.

In some cases, it has been found that all the beneficiaries are not able to deposit 5 percent cash in the bank. Instead they offer to contribute 25 rather than 20 percent of the estimated cost as labor. Or they ask committee members or other people to pay the cash on their behalf. Thus, a few people pay 5 percent of the total estimated cost and later recover this amount from those who do the extra voluntary work. It is FIWUD's experience that this approach works best in schemes where only improvements are needed rather than in new schemes without an existing organization. If there is no existing organization, beneficiaries who have promised extra labor instead of cash may refuse to pay after the project is approved, putting those who have paid in an awkward position, ultimately hampering progress.

This arrangement gives some flexibility to the beneficiaries in paying with either cash or labor contribution. It also assists FIWUD because the persons who have paid extra cash work hard to organize and mobilize the voluntary work of the scheme so that they can recover their deposits.

Voluntary Labor Contribution

The construction committee is responsible for raising the 20 percent voluntary labor contribution from beneficiaries. However, engineers from FIWUD help in assessing the contribution. The total labor contributed by each person is computed and payment is made for all contributions above the 20 percent mandatory voluntary labor contribution. Payment is made to the workers after deducting 20 percent contribution from the total work accomplished. It is the responsibility of the construction committee to give fair and just payment according to the individual record of work done. This is a difficult task and tests the effectiveness of the construction committee.

It has been observed that wherever the construction committee is strong and effective, the voluntary contribution is accomplished smoothly. In both new schemes and operating schemes, fewer problems are encountered in implementation and improvements if the committee is formed from among the farmer beneficiaries. However, if local or outside politics are involved in forming the committee, there are always problems in implementing the scheme.

Sometimes it is difficult to mobilize the voluntary labor due to local miscreants. Many instances have been observed where voluntary labor has been exploited in the name of the project. In such cases, a copy of the project approval paper is forwarded to the Chief District Officer to enable him to take action against the culprit.

The payment of employed laborers is generally done by the construction committee. If the workers feel that they are being exploited in payments, they complain first to the chairman of the construction committee who then must solve the problem. There have been examples where the workers were exploited by the chairman, as in the Kalikot case mentioned above. In such cases, the FIWUD staff may intervene if the conflict continues. The FIWUD staff tries to resolve problems with the help of the chairman and construction committee but, if conflicts continue, further payments are stopped by FIWUD until the problem is solved. If the chairman or a committee member misbehaves, the matter can be sent to the district panchayat and the chief district officer for settlement.

Although it is possible for the beneficiaries to change the chairman or committee members, money that has already been given to them may need to be recovered. The construction committee and FIWUD staff along with other beneficiaries try their best to solve the problems locally. However, when the miscreant is backed by influential people, the situation becomes complex. In this situation, the chief district officer intervenes on the request of the beneficiaries.

Long Duration for Project Implementation

Projects having a long (10-12 kilometer) canal to construct in the hills, take a long time to complete. First, because of the large amount of work, there is unwillingness to contribute the required amount of voluntary labor and cash. Second, because such projects involve various ethnic groups, different wards, and panchayats, it creates a difficult situation for coordination. Third, the difficult terrain, landslide zones, stream crossings, and complex issues involving water rights make the work difficult. And, fourth, at times political pressures and conflicting propaganda from local factions delay the implementation of a scheme.

Cash Balance after Construction Completion

Frequently in FIWUD schemes 5-15 percent of the estimated cost remains after the project is complete because of the energetic involvement of beneficiaries instead of a contractor in the construction. Inspection and supervision costs are reduced because beneficiaries themselves, as well as FIWUD technical staff, monitor the construction work. Although local workmen often lack skill in applying finishing touches to structures, the quality of the materials used is good and the results are durable. The money that is left after completion of the scheme is kept in the account and reserved for future repair and maintenance work.

Maintenance of the Schemes

Maintenance requirements differ from system to system. The water user groups are responsible for repair and maintenance of canals in FIWUD schemes. Although the water user groups are committed to raising funds for repair and maintenance of the system, in practice virtually no cash is mobilized for this purpose. Labor contribution by the beneficiaries is the most common feature of resource mobilization in these schemes. Large landholders must contribute more than small landholders.

The groups become more active just before the rice season. Usually they call a meeting and decide the ways and means of doing repair work. In many schemes the water user group employs two persons to patrol the canal during the rainy season, and at times these persons also look after and distribute irrigation water to farmers. Repairs which are within their capability, they do themselves. In case of massive damage, they immediately inform the leader as well as beneficiaries. In emergency cases almost all the beneficiaries go to the work site.

In FIWUD schemes where farmers have strong organizations (e.g., Dhaitar in Kavre district and Hoste Kholā in Sindhupalchowk district) there are regular mass mobilizations of labor, called *urdi*, for maintaining canals twice a year: once before land preparation for rice in May or June and another before sowing the winter crop. During *urdi* one person must come from each house for the work. Generally the repair work lasts four or five days. A fine of NRs 10 (US\$0.50) is charged to any household that does not contribute labor during the work period.

During the winter season, damage from rain and flood is minimal and individuals or small groups of farmers take care of their channels. In some cases the water users group allows a water-powered grain mill to be installed using water from the system. The mill owner then takes care of the canal maintenance work upstream of the mill.

If there is massive damage which is beyond the control of the beneficiaries, they can go to the Zonal Farm Irrigation Office for technical and financial help. In exceptional cases, FIWUD gives a nominal grant for repairing the system. This is only done if the results of a detailed survey indicate it is necessary. However, massive damage is not defined by fixed criteria. Farmers are considered capable of doing repairs involving earth work and dry stone work. However, massive stone masonry construction, or moving large stones and debris after a landslide (i.e., work which requires technical skills or machinery) are considered beyond their ability.

FUTURE FIWUD STRATEGY FOR STRENGTHENING FARMERS' PARTICIPATION IN IRRIGATION MANAGEMENT

Many irrigation projects fail to achieve the potential level of crop production possible. This is often due to defects in the management and application of irrigation water. Factors related to poor water management are closely linked with poor design and improper O&M. Such

problems lead to a reduction in benefits for farmers.

Another serious problem is environmental degradation caused by the construction. This is related to the topographical, geo-morphological, and geological conditions of the construction area. Landslides take place when water saturates the steep slopes and lubricates the soil layers. This may be caused by leakage from irrigation canals, from over-watering fields, or from excessive infiltration of rain water on terraced slopes. While surveying the site, a detailed study is made of the probability of these problems occurring, and the construction is modified accordingly.

In addition to these physical problems, efficient managerial aspects must also be considered. As competition among farmers for available water increases, improved system operation and management is called for to ensure widespread and equitable distribution of irrigation water. To achieve this, a coordinated effort to strengthen and improve existing organizations wherever necessary is suggested. This should take place in conjunction with a training program in system O&M. It is desirable to offer the farmers training on when, how, and how much to irrigate; canal system O&M; rotational irrigation during periods of water scarcity; improved terracing and cropping systems; and land preparation.

To address these problems in farmer-managed systems, FIWUD will establish another 6 zonal offices, thus providing staff and equipment to cover all 14 zones in Nepal effectively. Water management training along with a trial demonstration and production program will be extended in the completed schemes with the help of the agriculture development officer and staff of other related line agencies.

Permanent solutions to canal maintenance and landslide problems in the construction areas include soil conservation measures, such as tree planting on the uphill side of the canal. Terrace improvement work will also be gradually introduced as needed. A monitoring unit will be established to monitor the completed schemes and observe their performance to find ways to improve present construction methods and techniques. Survey and design criteria will be further refined with experience. The accounting procedure to be maintained by the construction committee will be further simplified and improved so that the committee can maintain satisfactory accounts.

During the seventh 5-year Plan, an additional 40,000 ha of land is to be irrigated. This will be covered by FIWUD as stated in the 1986 National Planning Commission Report.

Issues Regarding Government Intervention in Farmer-Management Irrigation Systems

1. Identification of schemes in terms of such factors as size, length, capital cost, and available time of beneficiaries, that would promote effective participation by farmers.
2. Development of simple procedures, which are also acceptable to the auditor, for recording expenditures by the construction committee.
3. Development of acceptable techniques for constructing channels in steep rock without major cutting and blasting.

4. Development of intake structures which can divert water efficiently at low river discharges.
5. Development of low cost diversion structures for the Tarai which can safely pass high discharges with a large amount of silt for both shallow and wide rivers and narrow and deep rivers.
6. Development of successful organizational models whose features could be incorporated into the systems that need improvement.
7. Development of low cost structural designs for the long stream-crossings in the hills.
8. Development of simple technology to check the seepage loss in the hill canals.
9. Test simple procedures for mobilizing voluntary contributions from the beneficiaries of irrigation schemes.

NOTES

¹Panchayat also refers to a local and district level administrative unit.

²The District Panchayat Chairman is the chairman of District Agriculture-Irrigation Committee and other line agencies like ADBN, Agricultural Input Corporation, and cooperatives are represented. The irrigation engineer, local development officer, and agriculture development officer are also members. This last is the member-secretary of the District Agriculture-Irrigation Committee.

³A copy of the letter is also sent to the district panchayat, local development officer, chief district officer, agriculture development officer, area and central office of the ADBN, and the department of agriculture.

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