FINANCING IRRIGATION SERVICES IN NEPAL

INTRODUCTION AND BACKGROUND

Nepal ranks as one of the poorest countries of Asia with annual per capita income in 1984 estimated by the Central Bureau of Statistics and the Nepal Rastra Bank to be about US$140. Over 90 percent of the population is dependent on agriculture for its livelihood, and agriculture provides over 59 percent of Nepal's Gross Domestic Product (GDP) (Ministry of Finance 1985). The agricultural resource base is severely constrained, because only 22 percent of the 141,000 square kilometers [14.1 million hectares (ha)] of surface area is cultivable. Nepal consists of three distinct geographic and climatic regions, distinguished primarily by elevation, which span the country from east to west. The *Tarai*, low elevation plains area of southern Nepal, includes less than 25 percent of the surface area but accounts for over 50 percent of the cultivated land. In contrast, the hill and mountain regions which make up over 75 percent of the surface area of Nepal, include less than 50 percent of the cultivated area (Asian Development Bank 1982a). Much of the mountain region is at high elevations where the climate is not suitable for agriculture. The majority of the cropped area is used for the production of food grains, with rice being the most important in terms of area cropped, production, and diet preference. Table 4.1 presents the area cropped, total production, and aggregate yield levels of the major grain crops in Nepal.

Table 4.1. Area, production, and yield of principal food grains, 1984/85.

Food grain	Area (ha)	Production (tons)	Yield (tons/ha)
Rice	1376860	2709430	1.97
Maize	578720	819150	1.42
Wheat	449960[a]	519960[a]	1.16
Millet	134370	124430	0.93

[a]Preliminary.
Source: Ministry of Finance (1985).

In Nepal the yield levels are low, particularly when compared to Southeast Asian countries, but also in comparison to other South Asian countries. Although in 1966, Nepal was estimated to have the highest rice yields among the countries of South Asia, it is now considered to have the lowest (Asian

Development Bank 1982a). Table 4.2 shows how yields of the major grains have generally declined between the 1960s and the 1970s as cultivation has been extended to marginal areas less suited for crop production. Crop failure due to drought in several years also contributed to this reduction in yields, highlighting the need for effective irrigation system management.

Table 4.2. Average yield of major crops from 1961-1971 and 1971-1981 (tons/ha).

Crops	1961/62-1970/71	1971/72-1980/81
Rice	1.92	1.88
Wheat	1.20	1.14
Maize	1.89	1.69

Source: Asian Development Bank (1982a).

The potential for increasing production through expansion of the area cultivated is negligible, and the rapidly growing population will have to be fed through more intensive production from land already being farmed.[1] The development and effective operation of irrigation systems are among the essential elements of a strategy for increasing agricultural output through the intensification of production.

Types of Irrigation

Differences in climate among the three geographic regions (Tarai, hills, and mountains), are primarily due to the effects of the vastly different elevations. The climate in the Tarai and much of the valleys and lower slopes of the hill area is suitable for intensive agricultural production, provided that irrigation is available. Both the government and the farmers have recognized for some time the importance of irrigation development. Of a total of approximately 1.9 million ha of potentially irrigable land, nearly 0.65 million ha currently receive irrigation. Table 4.3 shows the status of irrigation development in the Tarai and hills (the mountain region which has little irrigation is combined with the hills in the table) and the estimated potential irrigation from both surface and groundwater sources.

While there is potential nearly to double the area irrigated in the hills with an increase from 170,000 to 300,000 ha, most of the undeveloped potential and nearly 70 percent of the developed irrigation is in the Tarai. Of the estimated 1.6 million ha that could be irrigated in the Tarai, less than 30 percent is irrigated. Much of the groundwater irrigation potential has yet to be developed — less than 80,000 of a potential 428,000 ha is irrigated from underground sources. The potential area to be irrigated from groundwater sources accounts for more than 20 percent of the total irrigation potential.

A striking feature of irrigation in Nepal is that over 70 percent of the area irrigated is served by farmer-managed systems. These systems, which number in the thousands, vary in size from less than 10 ha to as large as 15,000 ha. Some are centuries old, and the majority have been in operation for

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[1]The population. which was 15 million in 1981 according to the census of that year is estimated to be growing at an annual rate of 2.7 percent.

Table 4.3. Land use and irrigation ('000 ha).

	Hill	Tarai	Total
Land area	10750	3400	14150
Cultivated land	1500	1600	3100
Land area irrigated			
Government-managed systems	18	168	186
Farmer-managed systems	160[a]	298[b]	458
	178	466	644
(Of which groundwater)	(-)	(77)[c]	(77)
Total potentially irrigable land	300	1600	1900
(Of which groundwater)	(-)	(428)	(428)

[a]Includes an estimated 8,000 ha developed by the Farm Irrigation and Water Utilization Division (FIWUD) and 2,000 ha by the Ministry of Panchayat and Local Development.

[b]Includes 48,000 ha irrigated by tube wells financed by the Agricultural Development Bank of Nepal.

[c]Includes 22,000 ha covered by Groundwater Development Board (National Council for Science and Technology 1985), 48,000 ha irrigated by tube wells financed by the Agricultural Development Bank of Nepal and 7,000 ha under FIWUD tube wells.

Sources: Adapted from Asian Development Bank (1982a), National Council for Science and Technology (1985), and Table 4.4.

decades at least. While some of the farmer-managed systems have received small amounts of assistance from the government in recent years, and possibly for their construction, they are operated and maintained solely by the irrigators. The irrigation bureaucracy in Nepal is relatively young, and the amount of land irrigated by systems constructed and managed by government agencies is estimated to be less than 200,000 ha.

Nearly all of the irrigation in Nepal has been developed for the production of rice. Fields are terraced, leveled, and bunded for irrigation by flooding. Gradually, maize and wheat have been incorporated into the cropping pattern in many of the irrigation systems. A common cropping pattern in irrigation systems in the hills with an adequate water supply is monsoon rice, winter wheat, and pre-monsoon maize or rice. The choice of pre-monsoon crop is primarily, but not exclusively, dependent on the water supply. If the supply is sufficient rice is grown, otherwise maize. In some hill irrigation systems, upland fields, which are not leveled and bunded, also receive irrigation for winter wheat and planting of a pre-monsoon maize crop. The area irrigated during the winter and pre-monsoon seasons, when the water supply is less than during the monsoon, is actually greater than that irrigated during the monsoon season in some hill irrigation systems (Martin and Yoder 1983).

Irrigation Institutions

There are a number of government agencies which are involved in the financing and construction of irrigation systems. Some of these are also responsible for the management of systems they develop, but others are not. A brief description of these institutions and their involvement in irrigation development and management follows.[2]

Department of Irrigation, Hydrology, and Meteorology (DIHM). This Department was established in 1952 with technical assistance from India and has been completely staffed by Nepali engineers and technicians since 1955. Reflecting the common ambiguity as to whether irrigation development should be coordinated more with agricultural or hydroelectric development, the Department has been under different ministries. To attempt to achieve better coordination, it was transferred in 1972 from the Ministry of Water and Power to the Ministry of Agriculture. In 1979, the department was shifted from the Ministry of Agriculture and Irrigation back to the Ministry of Water and Power. This ministry was renamed the Ministry of Water Resources in 1980, and DIHM remains under it.

DIHM is the primary agency engaged in irrigation development in Nepal. Its activities are concentrated on the investigation, design, construction, rehabilitation, and operation and maintenance (O&M) of systems with service areas larger than 500 ha in the Tarai and larger than 50 ha in the hills. In addition to the central office, it has regional directorates in the five development regions, several divisional offices, and field offices scattered throughout the country. In recent years, DIHM has operated the following number of systems.

Year	Number of systems
1982-1983	59
1983-1984	62
1984-1985	63
1985-1986	59

Irrigation systems under the Development Board Act. Not all of the large-scale irrigation systems are developed and managed by DIHM alone. Some of the large-scale irrigation systems, particularly those funded through foreign loans, are governed by a project board formed under the Development Board Act of 1956. These project boards include representatives from the Water Resources, Finance, and Agriculture Ministries; National Planning Commission; Department of Agriculture; and DIHM. Regional directors of DIHM and the Department of Agriculture may also be included as members. The secretary of the Ministry of Water Resources is the chairman of each of the boards, and the project manager, a DIHM engineer, acts as the member secretary. One purpose of the boards is to provide a more coordinated approach to irrigation development among the different agencies which

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[2]In December 1987, a ministerial reorganization was initiated with the intent of consolidating most irrigation activities, especially those of DIHM, FIWUD, and the Ministry of Panchayat and Local Development under a renamed Department of Irrigation. The Agricultural Development Bank of Nepal will continue its loan program for irrigation development. Hydrology and Meteorology have been separated from Irrigation in a new department.

are involved in the process. They also allow for some autonomy in personnel recruitment and financial flexibility. These boards are empowered to set their own water charges and to prescribe the collection method.

Farm Irrigation and Water Utilization Division (FIWUD). This Division was established in 1973 under the Department of Agriculture. It began its work in the Tarai with pump irrigation systems and has installed 46 tube wells serving an estimated 7,000 ha. FIWUD installs the tube well, including a pump house and water measuring tank; constructs a network of field channels for both irrigation and drainage; carries out a land improvement program which includes shaping, leveling, and consolidation; and introduces programs to increase cropping intensities and yields. Recently, it has become involved with the on-farm water management in some of the surface irrigation systems of DIHM in the Tarai, including some command area development projects. FIWUD has also begun developing small-scale gravity irrigation systems in the hills which are turned over to the farmers upon completion.

Ministry of Panchayat and Local Development. Through its regional and district offices, the Ministry of Panchayat and Local Development constructs small-scale irrigation systems, mainly in hill districts. Systems under 50 ha are considered the responsibility of the Ministry. Most of the integrated rural development projects assisted by donor agencies include an irrigation development component which is implemented by the District Technical Offices under the Local Development Officers of the Ministry. Much of their work involves providing technical and financial assistance to existing farmer-managed irrigation systems. The Ministry does not manage irrigation systems after construction. This is done by a local water users' committee.

Agricultural Development Bank of Nepal. The Agricultural Development Bank of Nepal has been involved in irrigation development through its loan programs since 1968, but most of its irrigation activity has taken place since 1981. In 1981, a pump irrigation loan program was initiated. More than 11,000 shallow tube wells serving an estimated 45,000 ha have been installed under this program. Over 700 open wells have also been constructed where boring for shallow tube wells was not feasible. For 1985/86, the Bank had an investment program to construct 2,300 shallow tube wells and 330 open wells, designed to irrigate about 10,500 ha.

The Agricultural Development Bank of Nepal also provides loans to groups of farmers for the construction of gravity irrigation systems. The systems for which this is done include those for which CARE (Cooperative for American Relief Everywhere)/Nepal has provided a subsidy, others implemented by FIWUD, and for systems implemented by only the Agricultural Development Bank of Nepal and farmers. The Bank has some technical personnel for the implementation of small-scale irrigation systems.

Table 4.4 presents an estimate of the area that is irrigated according to the institution that is responsible for its development. The systems under the management of a project board are included under DIHM as it is the lead institution in the development of these systems.

Table 4.4. Irrigation development according to institution.

Institution	Irrigated area (ha)	Irrigated area (%)
DIHM	179000[a]	27.8
FIWUD	15000[b]	2.3
Ministry of Panchayat and Local Development	2000	0.3
Agricultural Development Bank of Nepal	48000[c]	7.5
Farmer-managed	400000[d]	62.1
Total	644000	100.0

[a] Water and Energy Commission (1981), Ministry of Finance (1985).

[b] Discussions with M.M. Shrestha, Chief, FIWUD.

[c] Sekher Pradhan (1985).

[d] Water and Energy Commission (1981) — irrigation developed by the Agricultural Development Bank of Nepal, the Ministry of Panchayat and Local Development, and much of the FIWUD-developed is also farmer-managed.

Irrigation Development Budgets

The amount of expenditure for irrigation development has increased both in absolute magnitude and as a percentage of the development budget in successive Five-Year Plans. Table 4.5 presents the irrigation development expenditures for the past Four Plans.

Table 4.5. Irrigation development expenditure,[a] in million Nepal Rupees (NRs).

Plan	Irrigation development expenditure	% of development expenditure
Sixth	3130	14.4
Fifth	864	9.8
Fourth	265	4.9
Third	61	2.4

[a] Data for Sixth Plan are budget figures. The others represent expenditures.
Source: Water and Energy Commission (1981).

There is an increasing gap between the irrigation development budget for the construction of new systems and the regular irrigation budget for the O&M of existing systems. The low rate of allocation of funds for O&M, along with other factors such as poor design and construction, has resulted in a growing amount of development expenditure being needed for costly rehabilitation of systems which have become increasingly inoperable (Water and Energy Commission 1981). Table 4.6 presents the regular irrigation expenditure during different Plan periods and this expenditure expressed as a percentage of the irrigation development expenditure.

Table 4.6. Regular irrigation expenditures, in million Nepal Rupees.

Plan	Regular expenditure	% of development expenditure
Sixth	-	0.86[a]
Fifth	15.0	1.70
Fourth	7.6	2.90
Third	1.3	2.10

[a]Based on the first two years of Plan period.
Source: Water and Energy Commission (1981).

While these figures generally show an inadequate level of funding of O&M through the regular budget, they do not fully reflect the actual situation. Most of the regular budget is used to cover salaries of staff in the central and regional directorate offices, and very little provision is made for O&M of completed systems. There is a tendency to charge O&M expenses, including the salaries of regular DIHM personnel operating the system, to the development portion of the budget in systems which are in operation but are incomplete.[3] Funds are only made available for repairs after the event, and tend to be classified as development expenditures. These are taken from the channel renovation development budget allocation (NRs 65 million[4] in the Sixth Plan) until it is exhausted, at which time a supplementary request may be made to the Ministry of Finance (Water and Energy Commission 1981). It is, thus, impossible to say how much is actually expended in the irrigation sector for O&M.

GENERAL POLICIES REGARDING IRRIGATION FINANCING

Policies for financing irrigation services differ among the agencies involved in irrigation development. The majority of the construction of new irrigation facilities falls under DIHM. Financing of its irrigation construction comes out of the general development budget administered by the Ministry of Finance.

Through the Third Plan, the emphasis in irrigation development was on small- and medium-scale systems. Beginning with the Fourth Plan and the publication in 1970 of a master plan for irrigation development in the Tarai, a large infusion of foreign assistance for irrigation development has resulted in an ambitious expansion of irrigation development efforts. Nearly all costs of construction of new irrigation systems have been financed from external sources through grants or loans at concessionary rates, but the O&M costs of the systems are to be paid by Nepal.

Funds for O&M are allocated to the DIHM by the Finance Ministry from the general treasury. The policy is that farmers who benefit from irrigation services are to pay an irrigation service fee. This fee is set by the project board or by DIHM and is assessed in most systems on a per hectare per crop basis. Some systems have gone to an annual fee ner hectare. This has been controversial because in most of

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[3]This was reported in the Water and Energy Commission Irrigation Sector Review and was confirmed in interviews with project managers.

[4]US$ 1 = NRs 19.50 in 1986.

the systems the area that receives effective irrigation in the dry season is considerably less than that irrigated during the monsoon season.

FIWUD requires a 25 percent contribution by the farmers toward the cost of construction of a system. Before construction begins the farmers must deposit in a bank five percent of the estimated cost of the system. The additional 20 percent may be borrowed from the Agricultural Development Bank of Nepal or provided in the form of contributed labor. Upon completion of construction of a gravity irrigation system, it is turned over to the farmers who are responsible for its O&M. In the case of tube wells, FIWUD continues to operate the systems, and charges farmers according to the number of hours of pumping.

The policy and procedures of the Ministry of Panchayat and Local Development are influenced to a large degree by the donor agency funding an integrated rural development project covering the area in which an irrigation system lies. Farmers may be required to provide labor for construction, or the work may be contracted out to small contractors. After construction of the system, the farmers are responsible for O&M.

The Agricultural Development Bank of Nepal invests in irrigation development on a loan basis with individual farmers in the case of tube wells, or with groups of farmers in the case of gravity irrigation systems. The farmers are responsible for repayment of the loan for construction as well as for O&M costs.

CAPITAL COST OF IRRIGATION

The capital costs of different irrigation systems vary according to the type as well as size of the systems. The Asian Development Bank Agriculture Sector Strategy Study has estimated the capital costs of different types of irrigation systems. Five different modes of irrigation development are identified in Table 4.7. The figures are based primarily on feasibility studies.

Table 4.7. Capital costs of different types of irrigation development.

Type of system	Investment cost[a] (US$/ha)
Run-of-the-river diversion	
Partial development	1380-1900
Full development	2285-3050
Surface water storage	4290-6190
Command area development	1145-1715
Ground water sources	
Shallow tube wells	305-580
Deep tube wells	1430-2285

[a]1981 prices converted to 1984 prices using Implicit GDP Deflator (Asian Development Bank 1985).
Source: Asian Development Bank (1982a).

Little data is available concerning the actual per hectare investment costs of systems which have been completed. The Water and Energy Commission and the World Bank conducted an evaluation of four Bank-financed irrigation systems which yielded a wide range of cost figures (Table 4.8).

Table 4.8. Investment cost of selected systems.

	Kankai	NZIDP[a] Stage I	Mahakali Phase I	BLGWP[b]
Nominal cost[c]	9265	15358	2054	15250
Real cost[d]	13425	26783	3940	16820
Area commanded	5350	18730	5000	7500
Area irrigated	2100	9285	2500	300
Cost/ha commanded	2510	1430	788	2243
Cost/ha irrigated	6392	2885	1576	56069

[a]Narayani Zone Irrigation Development Project.

[b]Bhairahawa Lumbini Ground Water Project.

[c]'000 US$.

[d]'000 1984 US$ (1982 costs converted to 1984 costs using Implicit GDP Deflator).
Source: Water and Energy Commission (1982).

All of the systems were intended to irrigate the whole command area but were, by the time of the study, irrigating considerably less. As a result, the investment cost per hectare actually irrigated is much higher than planned. In the case of the Bhairahawa Lumbini Ground Water Project, the additional cost of expanding the area irrigated to a much larger percentage of the command area will presumably be relatively low, and the investment cost per hectare irrigated will be significantly reduced from that shown in the table.

A feasibility study of five systems in the western region of Nepal conducted by Gitec Consult (1980) estimated an average development cost of about US$3,500/ha for the entire 4,650 ha. The average unit development cost of the 4 systems deemed viable, covering a total of 2,765 ha, was about US$1,650.

The cost of a shallow tube well with a pump set was reported to be approximately NRs 9,000 or US$750 (Khoju 1981). These can irrigate four to five hectares, depending on the availability of groundwater, yielding a per hectare cost of US$150-200 in 1981-1982 dollars. The construction of the distribution channels is done by relatively inexpensive, unskilled labor, adding little to the development cost.

OPERATION AND MAINTENANCE COSTS

Irrigation systems operated by the government receive their budget allotment for O&M from the Ministry of Finance. The systems estimate their requirements for O&M, and these budgets are forwarded to the Central Office of DIHM. After O&M requirements are collected from all the

systems, discussions are held with the National Planning Commission and the Ministry of Finance. DIHM, with the approval of the Ministry of Water Resources, then submits a proposed budget for O&M to the Ministry of Finance. The Ministry of Finance finalizes the budget for inclusion in the national budget which is submitted to the National Panchayat by the Minister of Finance.

The irrigation systems do not have financial autonomy but must operate under the rules and regulations for government budgetary disbursements. Accordingly, repair and maintenance work costing up to NRs 5,000 can be done directly by the project manager. For maintenance work exceeding NRs 5,000 but less than NRs 25,000, quotations must be invited from interested contractors. When the amount exceeds NRs 25,000, tenders detailing the work to be done are required to be advertised. The contracting and tendering procedures have been reported to cause delays in the completion of needed construction and maintenance work (Pant and Lohani 1983).

Different rules-of-thumb are used to estimate the cost of O&M for surface and pump irrigation systems. For surface irrigation, the O&M cost is estimated to be NRs 300/ha, and for pump irrigation, NRs 900/ha. In both cases, farmers' contributions are not included.

Recent budgets for the Narayani Zone Irrigation Development Project are presented in Table 4.9. It is unclear whether the "construction" category refers to new construction or repair of existing structures and, likewise, how the salary and allowances should be divided between new construction and maintenance. The General Manager of the Narayani Zone Irrigation Development Project reported that the construction under the deep tube well system budget was new construction. Construction of the Stage-I surface irrigation structures was supposed to have been completed in 1983/84 (P. Pradhan 1985). This would imply that construction in 1984/85 and 1985/86 would be for repairs and maintenance.

Table 4.9. Narayani Zone Irrigation Development Project budgets, in Nepal Rupees. *Surface irrigation stage I*

Fiscal year	Salaries and allowances	Services	Construction	Total
1983/84	970000	139000	4000000	5109000
	(19)[a]	(3)	(78)	
	[87][b]	[13]	-	
1984/85	1050000	400000	1550000	3000000
	(35)	(13)	(52)	
	[72]	[28]	-	
1985/86	900000	421000	1500000	2821000
	(32)	(15)	(53)	
	[68]	[32]	-	

Deep tube well system

Fiscal year	Salaries and allowances	Services	Energy	Construction	Total
1983/84	740000	1426000	500000	2358000	5024000
	(15)	(28)	(10)	(47)	
	[28]	[53]	[19]	-	
1984/85	526000	1391000	1000000	2000000	4917000
	(11)	(28)	(20)	(41)	
	[18]	[48]	[34]	-	
1985/86	603000	1318000	700000	1000000	3621000
	(17)	(36)	(19)	(28)	
	[23]	[50]	[27]	-	

[a]Numbers in parentheses are percentage of total.

[b]Numbers in brackets are percentage of total minus construction.

Source: Government of Nepal Budgets, quoted in P. Pradhan (1985).

If it is assumed that in the financial years 1984/85 and 1985/86 the budget for the surface irrigation portion of the Narayani Zone Irrigation Development Project did not include new construction, then the O&M budget was distributed as follows: 30-35 percent for salaries and allowances; 13-15 percent for services; and 52-53 percent for maintenance-related construction. In the Narayani Zone Irrigation Development Project pump irrigation system, spare parts and electricity are the main components of the O&M cost, accounting for approximately 75 percent of the total (P. Pradhan 1985).

A recent study (Shrestha et al. 1984) computed the O&M expenditure for a sample of irrigation systems and compared this with the amount considered necessary for proper O&M. The results of the study are summarized in Table 4.10. The amount spent for O&M of large-scale irrigation systems ranged from NRs 105-207/ha while the amount needed to enable proper O&M was estimated to range from NRs 200-600/ha. For medium-scale irrigation systems, expenditure ranged from NRs 83-216/ha compared to an estimated NRs 175-300/ha needed for proper O&M.

Table 4.10. O&M costs of large- and medium-scale gravity irrigation systems, in Nepal Rupees.

Large projects	Kankai	Susari-Morang	Kamala	NZIDP[a]
O&M budget	1000000	6000000	525000	6500000
Net command area irrigated (ha)	5000	30000	16500	31400
Cost/ha	200	200	105	207
Amount needed/ha for proper O&M	300	600	200	245
Total budget required for proper O&M	1500000	18000000	3300000	7693000

Medium projects	Manusmaru	Jhanj	Hardinath	Pothraiya
Average cost	483580	455215	243112	431489
Net command area irrigated (ha)	5800	2900	2000	2000
Cost/ha	·83	157	122	216
Amount needed/ha for proper O&M	175	300	250	300
Total budget required for proper O&M	1015000	870000	500000	600000

[a]Narayani Zone Irrigation Development Project.
Source: Shrestha et al. (1984).

The average O&M cost of tube well irrigation systems was higher than that for gravity irrigation systems, ranging from NRs 317-714/ha. The amount required for proper O&M was estimated by project officials to range from NRs 333-1,000/ha. Figures for three tube well systems are presented in Table 4.11. Two of the three projects were able to spend nearly the amount estimated to be needed for proper O&M. This is probably because the major O&M expenditure in ground water systems is for energy to operate the pumps and for spare parts to repair the equipment. Without these expenditures the tube wells could not supply any water. Maintenance of the distributary canals for these systems is largely in the hands of the farmers. While the above mentioned amounts needed for proper O&M in tube well systems appear to be low, the Water and Energy Commission (1981) contends that the economic cost of electrical power (in contrast to the actual cost resulting from current highly subsidized tariff rates) is NRs 1,500-2,000/ha per annum.

Table 4.11. O&M costs incurred in tube well irrigation systems, in Nepal Rupees.

	FIWUD	BLGWP[a]	NZIDP[b]
Average cost	285308	3276600	2000000
Net command area irrigated (ha)	900	7600	2800
Cost/ha	317	431	714
Amount needed/ha for proper O&M	333	1000	770
Total budget required for proper O&M	299700	7600000	2156000

[a]Bhairahawa Lumbini Ground Water Project.

[b]Narayani Zone Irrigation Development Project.
Source: Shrestha et al. (1984).

Data for the medium-scale and tube well irrigation systems show a general increase in the expenditure for O&M in nominal terms over the past five years. Rising costs of labor and materials, however, were reported to have lowered the level of effective O&M that could be conducted with the limited budget. Annual expenditures for a sample of systems are presented in Table 4.12.

Table 4.12. Annual O&M expenditures for selected systems, in Nepal Rupees.[a]

Fiscal year	Manusmara	Jhanj	Hardinath	Pathraiya	FIWUD	BLGWP[b]
1979/80	504707	468502	256555	970625	260268	4158870
1980/81	539423	586080	256488	790735	286081	4294198
1981/82	517387	522748	295098	292333	309802	4965934
1982/83	702278	493921	157872	265226	367866	2229403
1983/84	526749	567246	249611	331460	403601	3694000

[a]Current Nepal Rupees converted to 1984 Nepal Rupees using Implicit GDP Deflator (Asian Development Bank 1985).
[b]Bhairahawa Lumbini Ground Water Project.
Source: Shrestha et al. (1984).

In summary, nearly all systems have reported that the O&M budget was inadequate for proper O&M. This is consistent with past evaluations of the irrigation sector, which cite insufficient resources for O&M of existing systems as a major deficiency (Water and Energy Commission 1981 and 1983; Asian Development Bank 1982a; and Svendsen, Macura, and Rawlings 1984).

For the fiscal year 1985/86 budget, however, the National Planning Commission reportedly followed a policy of consolidating the existing irrigation facilities through the provision of adequate funds for O&M. Particular emphasis was placed on providing adequate funding for O&M of systems judged to have a high potential for agricultural development (P. Pradhan 1985). The General Manager of the Narayani Zone Irrigation Development Project reported that the 1985/86 O&M budget for Stage I of the project, which is in operation, is sufficient to operate and maintain the system.

In addition to the budget allocation generally not being adequate, a common complaint voiced by project managers was that the budget was not released on a timely basis to allow for completion of the work (Shrestha et al. 1984). As mentioned above, irrigation systems are subject to the rules and regulations for government budgetary expenditures. The procedures for the release of funds are designed more to prevent leakages and to ensure proper accounting than for efficient and timely O&M of irrigation systems.

FARMERS' ABILITY TO PAY FOR IRRIGATION SERVICES

The farmers' ability to pay for irrigation services is a function of the quantities of output, the prices received, and the cost of production. These are determined by the government's 1) output price policies, 2) price policies for inputs other than water, and 3) tax policies, as well as by the cropping intensities and levels of production made possible by irrigation.

Output Price Policies

Rice, wheat, and maize are the major staple food crops in Nepal and the primary crops grown in most irrigation systems. Only rice and wheat are covered by government price policies. The basic philosophy of the government's price policy with respect to these staple foods has been to provide a floor price high enough to stimulate production, a ceiling price that provides reasonable price protection for consumers, and sufficient range between these two prices to provide traders and millers a reasonable profit for holding wheat and, particularly, rice between crop seasons. Each year the government announces a minimum support price just before the crop is harvested. When determining the floor price, the factors usually considered are: 1) the likely volume of production; 2) the maximum and minimum prices of the commodity in the previous year; 3) the price prevailing in markets on the Indian border, or the floor price announced in India for its crop; and 4) the cost of production of the crops.

On the basis of the above criteria, the floor price is calculated by the Food and Agricultural Marketing Services Division of the Ministry of Agriculture. The announced floor price does not have a major impact on the price received by farmers however, because the government cannot guarantee purchase of the product if the price falls below the floor price. The price received by the farmer depends upon the supply and demand situation in the market, particularly the Indian border market. In a good harvest year, the actual price received by the farmers may fall far below the level of the floor price announced by the government. In addition, the floor price is not announced before planting and, thus, has little influence on the farmers' management decisions.

The Nepal Food Corporation is the only government agency dealing with staple foods. It is responsible for distributing food to remote, food-deficit areas and for supplying food grains in the Kathmandu Valley and to the army and police. The primary objective of the food grain distribution policy of the government is to make food grains available in deficit areas at a reasonable price. Food grains are procured from exporters and millers at a pre-fixed levy price which at times has been as low as 50 percent of the domestic market price. Exporters and millers are required to sell a certain proportion to the Nepal Food Corporation at these reduced prices. The proportion that must be sold has varied and has recently been set for exporters at 10 percent of the amount exported. The authors of one study have argued that this tends to depress the market price in the Tarai area from where grain is exported (Karki and Neupane 1984). The general conclusion of that study and another by Rawal and Hamal (1984) is that government output price policies have failed to protect the farmers and if anything, have resulted in a reduction of the price received by farmers.

Price Policies for Inputs other than Water

The pricing of agricultural inputs such as improved seeds, pesticides, and tools is done by the Agricultural Inputs Corporation on a cost price basis. The cost price of these items includes the purchase price (or landed cost at the border if it is imported), plus the costs of handling and transportation to the district offices, and a minimum administration cost. Because the cost of transportation to the district centers varies considerably, the retail prices of these inputs differ among districts.

Prior to 1972, the pricing of fertilizer was done in the same manner. Since 1972, however, the government has classified fertilizer as an "essential item" and has adopted a policy of a single price throughout the country for each type of fertilizer. In so doing, the government must heavily subsidize the cost of transporting the fertilizer to the districts. In order to change the price of fertilizer, the Agricultural Inputs Corporation must submit, through the Ministry of Agriculture, a proposal to the cabinet justifying a change. The retail price of fertilizer has remained constant throughout each of the past two five-year plans as is shown in Table 4.13.

Table 4.13. Selling price of fertilizer (NRs/ton).

Year	Ammonium sulfate	Urea	Complex	Potash	T.S.P.	Compound (15:15:15)
1975/76[a]	1870	2440	2270	1573	3825	2210
1976/77	1870	2440	2270	1573	3825	2210
1977/78	1870	2440	2270	1573	3825	2210
1978/79	1870	2440	2270	1573	3825	2210
1979/80	1870	2440	2270	1573	2700	2210
1980/81[b]	2400	3100	2800	1573	2700	2740
1981/82	2400	3100	2800	1573	2700	2740
1982/83[c]	2400	3500	3250	1573	2700	3200
1983/84	2400	3500	3250	1573	2700	3200
1984/85	2400	3500	3250	1573	2700	3200

[a]Effective from December 1975.

[b]Effective from November 1980.

[c]Effective from April 1983.
Source: Agricultural Inputs Corporation.

The subsidy on fertilizer sold to the farmer is substantial. In 1984/85, the subsidy for different types of fertilizer ranged from 35-62 percent of the total cost of supply. Table 4.14 compares the annual selling price of fertilizer with the annual import price. Both prices are computed weighted averages of the different types of fertilizer supplied.

Because fertilizer is the most important cash input in Nepalese agriculture, it can be concluded that the government's input price policy enhances the farmers' ability to pay for irrigation services. Much more fertilizer is used in irrigated than in nonirrigated agriculture, and more is used in the Tarai and Kathmandu Valley, where nearly all of Nepal's commercial farming is located, than in the hills. Input price policies have less of an effect on incomes in the hills where less fertilizer is used and less of the output sold.

Tax Policies

Relatively little revenue is raised from the agricultural sector through taxes. Imports of fertilizers, pesticides, and seeds are exempted from tax. There is a one percent tax on agricultural implements

Table 4.14. Weighted average import and sale price of fertilizer (NRs/ton).

Year	Import price	Sale price	Sale price as percent of import price
1976/77	3730	2225	59.7
1977/78	3742	2221	59.4
1978/79	3822	2266	59.3
1979/80	3978	2299	57.8
1980/81[a]	4008	2889	72.1
1981/82	4028	2889	71.7
1982/83	4530	3284[b]	72.5
1983/84	4531	3308	73.0
1984/85[c]	4598	3336	72.6

[a]Effective from November 1980.

[b]Effective from July 1983.

[c]Provisional.

Source: Agricultural Projects Services Centre (1985).

and machinery. There is no agricultural income tax. The one tax that farmers must pay is the land tax which is levied at different rates according to land classifications. Land is classified according to factors which affect its productive potential including access to irrigation, soil type, elevation, and degree of slope. Land with a higher productive potential is taxed at a higher rate.

Current land tax rates are presented in Table 4.15. The nominal tax rate has changed little since 1968, with the effect that the real tax rate has declined. Revenues generated by the land tax have declined from 1.18 percent of the agricultural gross domestic product in 1964 to 0.38 percent in 1984 (Table 4.16). Furthermore, the proportion of total tax revenues generated from the land tax has been declining, and is now only 4 percent, as compared with 28 percent in 1964.

Table 4.15. Rates of land tax, 1985 (NRs/ha).

Land classification	Tarai	Valleys	Hills	
			Rice land	Sloping land
Awal	79	76	39	20
Doyam	68	65	34	15
Sim	54	52	30	10
Char	42	39	20	5

Source: Land Revenue Department (1985).

Table 4.16. Agricultural GDP,[a] total tax revenue and land tax revenue,[b] in million Nepal Rupees.

Year	Total GDP	Agriculture		Total tax revenue[c]	Land tax		
		GDP	% of total GDP		Revenue	% of total tax revenue	% of agri- cultural GDP
1964-65	5602	3654	65	151	43	28	1.18
1965-66	6909	4794	69	177	45	25	0.94
1966-67	6411	4292	67	226	57	25	1.33
1967-68	7173	4883	68	284	83	29	1.70
1968-69	7985	5357	67	368	79	21	1.48
1969-70	8768	5922	68	411	88	21	1.49
1970-71	8938	6034	68	396	76	19	1.26
1971-72	10369	7106	69	467	83	18	1.17
1972-73	9969	6578	66	521	75	14	1.15
1973-74	12808	8851	69	700	97	14	1.09
1974-75	14802	9949	70	844	91	11	0.92
1975-76[d]	17394	11611	67	922	95	10	0.82
1976-77	17280	10506	61	1102	98	9	0.93
1977-78	19732	11752	60	1244	87	7	0.74
1978-79	22216	13522	61	1477	59	4	0.44
1979-80	23351	13688	59	1529	65	4	0.47
1980-81	27307	15674	57	2036	109	5	0.69
1981-82	30265[e]	15727	52	2211	84	4	0.53
1982-83	33621[f]	17946	53	2421	67	2	0.37
1983-84	38184[g]	20482	54	2132	77	4	0.38
1984-85	41738	21680	52	-	-	-	-

[a]World Bank Report No. 2692 NEP.

[b]Ministry of Finance (1982).

[c]These figures are from the new series of the National Planning Commission which assessed GDP at NRs 16,571 million and agriculture GDP as NRs 11,550 million in 1974/75.

[d]Total tax revenue.

[e]Revised estimate.

[f]Provisional revised estimate.

[g]Provisional estimate.

While the agricultural sector has not been heavily taxed, government tax policy has also not been used to protect producers from foreign competition. There is no import tax levied on cereal grains or on other agricultural products including vegetables, fruits, and live animals. On the export of these items, there is a one percent export tax.

Direct Irrigation Benefits

The provision of irrigation services can enable a large increase in both cropping intensity and crop yields. A comparison of several hill villages (Martin 1986) revealed that farmers with irrigation systems were cultivating three crops per year. The cropping pattern was monsoon rice, winter wheat,

and pre-monsoon maize or rice. Total annual yields of grain for the three seasons averaged 7.5-9.0 tons/ha. Farmers in the same environment but without irrigation grew only one rain-fed maize crop per year with yields of less than three tons/ha.

The production levels reported above were achieved in irrigation systems which were effectively and exclusively managed by the farmers themselves. On the other hand, the Agricultural Projects Services Centre and the Water and Energy Commission have documented the performance of various large- and small-scale irrigation systems in both the hills and Tarai which were constructed and managed by the government. The overall conclusion of these studies is that in terms of cropping intensity, yields and farm incomes, there was only marginal improvement in the project areas as compared with neighboring control areas (Agricultural Projects Services Centre 1978 and 1982, Water and Energy Commission 1982). More specifically, the Water and Energy Commission study found that the proportion of the cultivated area on which only one crop is grown per year is higher in project commands than in nearby nonproject areas, and that while cropping productivities vary considerably among the different areas of study, there is no significant difference in cropping productivities between project and nearby nonproject areas.

Because effective irrigation can clearly make possible much higher yields and cropping intensities in comparison to those possible under rain-fed conditions, at least two factors are likely to contribute to the results noted above. The first, which the studies explicitly state, is that the irrigation systems studied are not well-managed. The second, which is not discussed in the reports, is that the nonproject areas with cropping intensities greater than 100 percent may have been irrigated by farmer-managed irrigation systems. If this is the case, the comparison was not between irrigated and nonirrigated production but rather between areas irrigated by two different types of irrigation systems.

An Agricultural Credit Review conducted by the Nepal Rastra Bank in 1980 compared yields, cropping intensities, and cost of production between irrigated and non-irrigated farms. The study included a sample of over 2,600 households in 14 of the 75 districts in both the hills and Tarai. Cropping intensities were not found to be as much higher on irrigated than nonirrigated farms as would be expected. The study speculated that this may be due to a time-lag between the provision of irrigation and intensification of production, problems of water management, nonavailability of credit, and a lack of extension facilities (Nepal Rastra Bank 1980). Table 4.17 presents a comparison of the cropping intensities observed, delineated according to region and farm size.

Table 4.17. Cropping intensity on irrigated (IR) and nonirrigated (NIR) land (percentage).

Region	All farms		Large farms		Medium farms		Small farms		Marginal farms	
	IR	NIR	IR	NIR	IR	NIR	IR	NIR	IR	NIR
Hills	158	130	155	126	160	140	181	144	198	149
Tarai	146	135	152	129	136	131	145	137	166	153
Overall	147	134	152	128	137	132	145	138	166	153

Notes: **Large:** hills > [1.0 ha, Tarai > [5.4 ha; **medium:** hills = 0.5-1.0 ha, Tarai = 2.7-5.4 ha; **small:** hills = 0.2-0.5 ha, Tarai = 1.0 to 2.7 ha;
marginal: hills <] 0.2 ha, Tarai >] 1.0 ha.
Source: Nepal Rastra Bank (1980).

To understand the impact of irrigation, one also needs to know the crops that are actually grown as well as the yields of the various crops under different conditions. The major crops that are grown under irrigated conditions are rice and wheat. Table 4.18 presents the range (over the size categories of farms) of yields recorded for the two regions for these crops under irrigated and nonirrigated conditions for both improved and local varieties. The data in the table show that the combination of improved varieties and irrigation results in a significant increase in rice yields. In the hills the increase per hectare was from two to three tons, while on the Tarai it was about one ton. The impact of these factors on wheat yields, while positive, is less. Often in the absence of irrigation, the crop grown is maize or millet. The ranges of yields for nonirrigated maize and millet are presented in Table 4.19.

Table 4.18. Yields on irrigated and nonirrigated farms (tons/ha).

Region	Crop	Irrigated	Nonirrigated
Hills	Improved rice	3.3 - 4.6	-
	Local rice	1.1 - 2.2	1.4 - 1.6
	Improved wheat	1.0 - 1.5	0.8 - 1.2
	Local wheat	0.6 - 0.8	0.5 - 0.7
Tarai	Improved rice	1.9 - 2.3	1.0 - 1.2
	Local rice	1.4 - 1.9	1.1
	Improved wheat	1.0 - 1.5	0.9 - 1.2
	Local wheat	0.6 - 1.1	0.5 - 0.7

Source: Nepal Rastra Bank (1980).

Table 4.19. Nonirrigated maize and millet yields (tons/ha).

Crop	Hills	Tarai
Improved maize	0.7 - 1.9	0.6 - 1.7
Local maize	0.5 - 1.0	0.7 - 1.6
Local millet	0.8 - 1.0	0.5 - 1.1

Source: Nepal Rastra Bank (1980).

Estimates of Farmers' Ability to Pay for Irrigation Services

The farmers' benefits from irrigation depend not only on the cropping intensity and yields but also on the costs of production and the value of the output. A comparative analysis of the net income from irrigated and nonirrigated agriculture is one approach to estimate the farmers' ability to pay for irrigation services. While all project appraisal documents show significant gains in net income from the introduction of irrigation, *ex-post* analyses tend to be less conclusive. This is largely due to the problems mentioned in the previous section concerning the quality of irrigation management and the actual water status of the area outside the irrigation system which is used as the nonirrigated area in the comparative analysis.

Information on the net income from crop production under current irrigation conditions in three irrigation systems is presented in Asian Development Bank (1982b). Because these systems were identified for the implementation of command area development, they are probably fairly representative of production in irrigation systems in the Tarai. The net returns calculated per hectare of irrigated crop production in the two systems which were already in operation are presented in Table 4.20. The same study estimated annual farm incomes under current conditions for two farm sizes for observed cropping patterns and intensities. The estimated farm budgets for the two systems are shown in Table 4.21.

Table 4.20. The status of net financial returns from irrigated crop production[a] for Chandra and Mohana systems (NRs/ha, 1982 prices).

Crop	Chandra		Mohana	
	Current	Postcommand area development[b]	Current	Postcommand area development[b]
Rice	3606	6269	2401	3881
Wheat	3119	6104	2549	3887

[a]Excludes land tax and water change.

[b]Estimated after implementation of command area development project.
Source: Asian Development Bank (1982b).

Table 4.21. Annual farm budgets in two irrigation systems, in Nepal Rupees.

System	Chandra		Mohana	
	Farm size (ha)		Farm size (ha)	
	0.6	1.9	0.7	1.9
Cropping intensity (%)	166.00	166.00	184.00	184.00
Cropped area (ha)				
Rice - irrigated	0.56	1.81	0.22	0.58
Rice - unirrigated	0.02	0.05	0.46	1.23
Wheat - irrigated	0.18	0.57	0.20	0.56
Wheat - unirrigated	-	-	0.11	0.30
Lentils	0.02	0.05	0.24	0.65
Maize	0.02	0.05	0.03	0.09
Mustard	0.02	0.05	0.01	0.03
Linseed	0.18	0.57	0.02	0.06
Total	1.00	3.15	1.29	3.50
Production (tons)[a]				
Rice - irrigated	1.16	3.78	0.33	0.88
Rice - unirrigated	0.02	0.04	0.35	0.93
Wheat - irrigated	0.25	0.80	0.29	0.80
Wheat - unirrigated	-	-	0.10	0.29
Lentils	0.01	0.02	0.09	0.25
Maize	0.03	0.07	0.04	0.13
Mustard	0.01	0.02	0.01	0.02
Linseed	0.03	0.08	0.01	0.01
Production value[a]	3615.00	11410.00	2555.00	6866.00
Production cost	404.00	1927.00	361.00	987.00
Farm margin before land tax and irrigation fee	3211.00	9483.00	2194.00	5879.00

[a]Including five percent storage loss.
Source: Asian Development Bank (1982b).

Because irrigation service fees tend to be based on the area irrigated per crop, the data from the above study are placed on a per hectare basis. To simplify the analysis it is assumed that a cropping intensity of 166 percent can be achieved on 1 ha of irrigated land by growing an irrigated rice crop on the full hectare followed by an irrigated wheat crop on two-thirds of a hectare. In the absence of irrigation it is assumed that one rain-fed rice crop per year would be grown over the entire hectare. Using the net returns per hectare given for the different crops in the study, the estimated annual incremental net income as a result of irrigation, in the absence of payment of direct and indirect irrigation charges, is presented in Table 4.22. The analysis is done for the current situation as well as for that estimated to be achieved after completion of command area development. The current annual incremental returns from irrigation are estimated to be approximately NRs 3,550 and 2,830/ha for the 2 systems. After the command area development has been done, it is estimated that the per hectare incremental returns will increase to NRs 8,180 for Chandra and 5,190 for Mohana.

Table 4.22. Incremental net income from irrigation, in Nepal Rupees at 1982 prices.

	With irrigation			Without irrigation	Incremental
	Rice	Wheat	Total	Rice	net income/ha
Area (ha)	1.00	0.66	1.66	1.00	-
Chandra					
Current					
Yield (tons/ha)	2.20	1.50	-	1.10	-
Net returns/ha	3606.00	3119.00	-	2117.00	
Net returns	3606.00	2059.00	5665.00	2117.00	3548.00
Post-CAD					
Yield (tons/ha)	3.80	3.10	-	1.10	-
Net returns/ha	6269.00	6104.00	-	2117.00	-
Net returns	6269.00	4029.00	10298.00	2117.00	8181.00
Mohana					
Current					
Yield (tons/ha)	1.60	1.50	-	0.80	-
Net returns/ha	2401.00	2549.00	-	1255.00	-
Net returns	2401.00	1682.00	4083.00	1255.00	2828.00
Post-CAD					
Yield (tons/ha)	2.80	2.70	-	0.80	-
Net returns/ha	3881.00	3887.00	-	1255.00	-
Net returns	3881.00	2565.00	6446.00	1255.00	5191.00

Source: Asian Development Bank (1982b).

There is thus considerable scope for payment for irrigation services from the estimated incremental net value of production under irrigated conditions. At NRs 60/ha per crop the annual irrigation service fee per hectare would be NRs 100, which is 1-4 percent of the incremental net income calculated in Table 4.22. If the fee were NRs 100/ha per crop, it would amount to 2-6 percent of the incremental net income.

An alternative approach to evaluating the farmers' ability to pay for irrigation services is to consider the total net income earned from irrigated agriculture relative to some minimally acceptable reference income level. In order to facilitate comparisons among the other country studies, the data are expressed in terms of the equivalent amount of unmilled rice.

Data calculated from the Asian Development Bank (1982b) giving indicative costs and returns to irrigated rice and wheat production are presented in Table 4.23. For rice production, two alternative assumptions about the levels of yields and inputs are given. The lower figures represent the current situation observed in some existing irrigation systems, while the higher figures represent a reasonable expectation of what could be achieved. Assuming again that a typical irrigated cropping pattern is a rice crop on the entire area followed by a wheat crop on 66 percent of the area, the indicative costs and returns per hectare of irrigated agriculture are also presented in Table 4.23. The figures represent the returns to all family resources (land, labor, capital, and management) assuming that all land is owned by the family. In situations where part of the land is rented, the returns would be correspondingly lower.

Table 4.23. Indicative costs and returns to irrigated rice, wheat, and agricultural production (per ha).

	Low yield		High yield	
	NRs	Kg rice[a]	NRs	Kg rice[a]
Rice				
Gross production	4858	2200	8390	3800
Water charge	100	45	100	45
Other purchased current				
inputs excluding labor	439	199	1087	492
Hired labor	440	200	517	234
Returns to family resources[b]	3879	1756	6686	3029
Wheat				
Gross production	4208	1906	8415	3811
Water charges	100	45	100	45
Other purchased current				
inputs excluding labor	725	328	1747	791
Hired labor	154	70	143	65
Returns to family resources[b]	3229	1463	6425	2910
Agricultural Production[c]				
Gross production	7635	3458	13944	6315
Water charge	166	75	166	75
Other purchased current				
inputs excluding labor	918	416	2240	1014
Hired labor	594	269	611	277
Returns to family resources[b]	5957	2698	10927	4949

[a]Unmilled rice.

[b]If family owns all land farmed.

[c]Assumes a rice crop on 1.00 ha and wheat on 0.66 ha.
Source: Asian Development Bank (1982b).

Estimates of the returns to family resources, in terms of kilograms of unmilled rice per hectare, that would prevail under four alternative scenarios are presented in Table 4.24 for low and high productivity agriculture. The second column shows the situation that would prevail if the irrigation service fee was raised to a level to cover the full costs of O&M. The final two columns show the situation if the fee is raised to cover both full O&M and full capital costs, under two different assumptions about the magnitude of the capital investment.

Table 4.24. Hypothetical costs and returns to irrigated agriculture assuming changes in policies regarding water charges (kg rice[a]/ha).

	Present policy	Water charges revised to cover		
		Full cost of O&M	100% cost recovery O&M plus capital cost assuming investment cost	
			Low	High
Low production				
Gross receipts	3458	3458	3458	3458
Charges related to water[b]				
O&M	75	136	136	136
Capital cost	-	-	905	1567
Other purchased inputs excluding labor	416	416	416	416
Hired labor	269	269	269	269
Returns to family resources[c]	2698	2637	1732	1070
High production				
Gross receipts	6315	6315	6315	6315
Charges related to water[b]				
O&M	75	136	136	136
Capital Cost	-	-	905	1567
Other purchased inputs excluding labor	1014	1014	1014	1014
Hired labor	277	277	277	277
Returns to family resources[c]	4949	4888	3983	3321

[a]Unmilled rice.

[b]Assuming farmers pay water charges assessed.

[c]If family owns all land farmed.

To place the net return figures in Table 4.24 in perspective, it is useful to consider these estimated returns relative to certain reference levels of income. Data underlying two reference income levels for the Tarai are presented in Table 4.25. The first reference level is what we have termed "parity farm household income" expressed on a per hectare basis (line 5 of Table 4.25). "Parity" income represents a level of income per hectare which, given the average farm household size and the average farm size in the Tarai, is comparable to the average per capita income for Nepal. The second reference income level is an estimated absolute poverty level of income. The estimated per capita absolute poverty level (Asian Development Bank 1982a) was converted to a per hectare basis in the same manner as for the "parity" income.

Table 4.25. Calculation of income reference levels for the Tarai, 1982, in Nepal Rupees.

Item	Amount
Average per capita income[a]	2168.00
Average farm household size (persons)[b]	7.00
"Parity" farm household income (1 x 2)	15176.00
Average farm size in Tarai (ha)[c]	2.30
"Parity" farm household income per hectare (3 ÷ 4)	6598.00
Estimated per capita absolute poverty income[d]	1050.00
Estimated farm household "poverty" income (2 x 6)	7350.00
Estimated poverty level income per hectare (7 ÷ 4)	3196.00

[a]Central Bureau of Statistics and Nepal Rastra Bank, in P. Pradhan (1985).

[b]Nepal Rastra Bank (1980, I:14).

[c]Nepal Rastra Bank (1980, II:13).

[d]Based on 1975/76 figure of NRs 730 (Asian Development Bank 1982a) adjusted to 1982 prices using Implicit GDP Deflator.

Table 4.26 presents the estimated effects of different irrigation service charge policies on family incomes under the assumptions of low and high yields, respectively. Under current policy, returns to family resources equal 90 percent of "parity" farm incomes under the low yield assumption and 166 percent under the high yield assumption. In contrast to the other countries studied, incomes from irrigated agriculture are nearly equal to "parity" even with the assumption of low yields and exceed "parity" under the high yield assumption. This does not reflect a higher productivity of irrigated agriculture in Nepal relative to the other countries, but rather the low level of per capita incomes. Because nearly 90 percent of the population is engaged in agriculture, this low per capita income is determined primarily by agricultural income, which is dominated by rain-fed agriculture. It is thus not surprising that irrigated agricultural incomes might exceed "parity" under current policy.

Changing to a policy of water charges to cover all O&M costs has little effect on the returns to irrigated agriculture. An important question is whether the level of O&M expenditures reported to be adequate is truly sufficient. Comparison with the other studies shows that both the actual expenditures on O&M and the amount considered adequate are lower in Nepal than in the other countries. This is likely in part due to lower wage rates in Nepal, but may also reflect the conclusions of several studies (Water and Energy Commission 1981 and 1983; Asian Development Bank 1982a; and Svendsen, Macura, and Rawlings 1984) that insufficient resources are allocated for the O&M of existing systems.

If full cost recovery is imposed, returns drop drastically. Under the assumption of low yields, returns to family resources drop to 120 percent of the "poverty" income level if the capital cost is low, and to only 74 percent if the capital cost is high. With the assumption of a higher level of yields, under all scenarios concerning irrigation service fee policies, returns to family resources remain above "parity" and are more than two times higher than the "poverty" income level. This again is more a reflection of the low level of reference incomes rather than the productivity of irrigated agriculture in Nepal; the analysis, however, indicates that there is scope for recovering more of the cost of irrigation development from the farmers who directly benefit from it.

Table 4.26. Estimated effects of changes in policy regarding water charges on returns to family resources (if family owns all lands farmed), 1982.

	Present policy	Water charges revised to cover		
		Full cost of O&M	100% cost recovery O&M plus capital cost assuming investment cost	
			Low	High
Low production				
Farm returns				
kg unmilled rice/ha[a]	2698	2637	1732	1070
Relative to "parity" (%)[b]	90	88	58	36
Relative to "poverty" (%)[c]	186	182	120	74
High production				
Farm returns				
kg unmilled rice/ha[a]	4949	4888	3983	3321
Relative to "parity" (%)[b]	166	164	133	111
Relative to "poverty" (%)[c]	342	337	275	229

[a]From Table 4.24.

[b]"Parity" farm income/ha NRs 6,600 or 2,989 kg of rice, Table 4.24.

[c]"Parity" farm income/ha NRs 3,200 or 1,449 kg of rice, Table 4.24.

METHODS OF FINANCING IRRIGATION SERVICES

Direct Methods

It has been the policy of the government of Nepal since the 1950s to collect water charges from farmers receiving irrigation services. Water charges as defined by the Canal, Electricity, and Related Water Resources Act (1967) have been in effect in nearly all of the government irrigation systems in both the hills and Tarai. Prior to 1975, farmers were charged a flat rate of NRs 9/ha per year. This was increased to NRs 60/ha per crop. Some, but not all, of the systems under the authority of a project board have set the fee at NRs 100/ha per crop. The rates are set either by the project board or by DIHM, subject to the approval of the Ministry of Finance.

While there is a fairly standard rate structure, it has not been implemented consistently in all systems, and collection of fees has been ineffective. In the Kamala Irrigation Project, irrigation service fees have not yet been imposed even where the main and branch canals have been in operation since 1979/80. In the Kankai System, farmers are required to pay for only two crops, even if they irrigate a third crop in the winter. In contrast the Narayani Zone Irrigation Development Project charges a flat rate of NRs 200/ha per year irrespective of the number of crops grown. Thus, while farmers in the Kankai System are given free water in the winter to encourage cropping in this season, farmers in the Narayani Zone Irrigation Development Project are charged for two crops per year (even if they plant only one) to encourage them to plant a second crop. The Chitwan Irrigation Project, while a large-scale irrigation project under a project board, charges only NRs 60/ha per crop instead of NRs 100.

The Tube Well Irrigation Project of the Narayani Zone Irrigation Development Project has set the rate at NRs 100/ha per crop, except for sugar cane which is charged NRs 300/ha. For the groundwater systems managed by FIWUD, on the other hand, a system of water pricing based on the time of operation of the pump is used. FIWUD charges at a rate of NRs 16/hour in the case of non-artesian wells. An estimated 10 hours of pump operation is required to provide one watering to a hectare of rice. For artesian wells, the FIWUD charge varies according to the range of water discharge of the well as shown in Table 4.27. The wells are categorized according to discharge rates, and a price per hour of operation is charged. Because the actual discharge may fluctuate substantially from the nominal rate, this does not represent an exact volumetric charge. The hourly rates were reduced significantly in 1980.

Table 4.27. Water charge in artesian wells operated by the Farm Irrigation and Water Utilization Division, in Nepal Rupees.

Range of discharge (cusecs)	Current water charge/hour	Water charge/hour prior to 1980
0.10 - 0.25	1.0	3.0
0.26 - 0.50	2.0	5.0
0.51 - 0.75	3.0	7.0
> 0.75	4.0	9.0

Source: Shrestha et al. (1984).

According to the Director General of DIHM, the level of the water charges to raise needed revenues is set subject to the farmers' capacity to pay the water charges. This was given as the reason why the Chitwan Project did not raise the rates to NRs 100/ha per crop as was done in the other large-scale irrigation systems under project boards. It was also cited as the reason why FIWUD lowered the rates charged for water from artesian wells.

In addition to paying water charges, farmers are expected to provide labor for maintenance of the field channels. Most of the systems constructed with external funding call for the establishment of water users' groups at the tertiary level to carry out this work. According to P. Pradhan (1985:23), the water users' groups in the government-operated irrigation systems exist on paper only, and "there is no interaction between these groups and operation and maintenance of the systems." Nevertheless, the farmers are likely involved in O&M at the tertiary level. It is difficult for system managers to manage the water to that level effectively, and farmers have to become involved if they are to be able to irrigate. The study by No-Frills Development Consultants (Shrestha et al. 1984) found farmers generally willing to provide labor for maintenance, provided the tertiaries had been constructed and that water delivery was relatively satisfactory. Further field study is needed to determine the magnitude of the resources that farmers are contributing to the O&M of government irrigation systems.

In the farmer-managed irrigation systems, which account for the majority of the irrigated area in Nepal, farmers provide all the resources for O&M of the systems.[5] While this is mainly in the form of labor, in some systems it may also involve significant amounts of cash. The average annual labor contribution for 6 hill systems studied in detail by Martin and Yoder was 68 man-days/ha (Martin 1986). In one system of 35 ha, annual labor contributions were approximately 50 man-days/ha, while cash assessments were NRs 265 and 440/ha in the 2 years which the system was observed. If the labor is valued at the local wage rate of NRs 10/day, the annual value of resources mobilized from the irrigators for system O&M is NRs 750-1,000/ha. Even if the labor is costed at only half the wage rate, the value of resources mobilized is NRs 500-700/ha per year. P. Pradhan (1984) found the value of labor contributions in a farmer-managed system in the Tarai with an irrigated area of more than 3,000 ha to exceed NRs 270/ha for only the monsoon rice season.

Clearly, farmers are able and willing to pay a significant amount for the O&M of their irrigation systems. Agricultural Projects Services Centre (1979) found that farmers in the Waling area (Syangja District) indicated a willingness to pay NRs 50 per *ropani* (0.05 ha) or about NRs 1,000/ha. Farmers in some of the government irrigation systems indicated a willingness to provide free labor for minor repairs of the tertiary canals if the system could assure that irrigation would be supplied in a timely manner. The General Manager of the Narayani Zone Irrigation Development Project maintained that he could increase collection rates if he could be assured of receiving the agreed-upon amount of water from India.[6] (The headworks and a long stretch of the main canal are in India and not under the control of Narayani Zone Irrigation Development Project or DIHM.) Farmers, in general, have been reported to be willing to pay the NRs 60-100/ha charge for the dry-season crop but question their being billed the same amount for the monsoon crop (Shrestha et al. 1984). Farmers argue that they were traditionally able to grow a monsoon crop before the establishment of the irrigation system and, thus, receive less benefit from it in that season than in the dry season.

Assessment, billing and collection procedures. Collection of irrigation service fees from the farmers was once done by the Land Revenue Office along with the collection of the land tax, but the Land Revenue Office refused to continue collection without the provision of additional staff (Water and Energy Commission 1983). Responsibility for assessment and collection of the fees was then shifted to the irrigation system management.[7]

Because the charge is to be a user fee, it is necessary to determine whose land has received irrigation in a given season. In each season, a surveyor investigates which land has been provided irrigation. In the Narayani Zone Irrigation Development Project, one of the responsibilities of the leaders of water users' groups is to "witness the inspection of irrigated and nonirrigated areas for assessment of water charges and to cooperate in collection of water charges" (B.B. Pradhan 1982).

The bill for irrigation is not sent directly to the farmers. Notification is made to the concerned village *panchayat* (local government) office, and a notice is also posted on the project office notice-board. The farmers are then expected to come to the project office to make their payments. According to the

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[5]The original construction investment, primarily in the form of labor, was also likely provided by the persons farming the land. At the time of construction, these may have been tenants of someone who had been awarded a large land grant in return for service to the government.

[6]Personal communication, February 1985.

[7]In 1987 the government decided that water charges are to be collected by the Land Revenue Office under the Ministry of Land Administration.

Water and Energy Commission (1983), collection rates in the Chitwan System were substantially increased by also sending surveyors to collect the fees from the farmers rather than waiting for farmers to bring their payment to the project office.

Besides the difficulty of determining the land actually irrigated, there is a problem in many cases of identifying the individual who is responsible to pay the charge. According to the law, it is the land owner who is responsible for payment, and in the case of owner-operators, there is no problem of identification. There is controversy, however, when cultivation is being done by a tenant. In many districts in Nepal, the land rent has been fixed, entitling the landowner to a fixed amount of rent on the main crop. In such a case, the tenant receives more benefit from the irrigation facility than the owner, and the landowner would like the tenant to pay the water charge (P. Pradhan 1985).[8] The practice is that the landowner pays the water charge for the main crop, and the tenant for the second crop, even though the owner is legally responsible for payment.

Collection efficiencies and enforcement. The rate of actual collection of irrigation charges from farmers has been very low, whether measured as a percentage of a) the annual amount budgeted to be collected, b) the assessed amount, or c) the amount spent for O&M. Table 4.28 compares the amounts collected with that budgeted to be collected. For the past 10 years especially, the ratio of the amount of water charges collected compared to the amount budgeted to be received has been very low. As a result of this poor performance, the budget has been considerably reduced despite a steady increase in the total area irrigated by government irrigation systems.

Table 4.28. Budget estimates and collection of water charges, in thousand Nepal Rupees.

Year	Budget estimate	Collection	Collection as a percentage of budget
1968/69	200	240	120
1969/70	505	175	35
1970/71	269	171	64
1971/72	300	219	73
1972/73	200	22	11
1973/74	300	348	116
1974/75	1000	336	34
1975/76	1000	279	28
1976/77	2000	610	31
1977/78	6520	985	15
1978/79	5500	694	13
1979/80	5000	1300	26
1980/81	1500	500	33
1981/82	1100	600	55
1982/83	-	900	-
1983/84	-	1000	-

Sources: Ministry of Finance (1982 and 1985).

When the amount of water charges collected is compared to the cost of O&M, the percentages are even lower. These figures are compared for several irrigation systems in Table 4.29. The ratio of water charges collected to actual O&M costs is extremely low for this sample of systems. It is above 10 percent only for Jhanj and Patharaiya. Considering that the expenditure for O&M in these 2 systems was only 52 and 72 percent of that estimated to be needed to pay for proper O&M (Table 4.10), the amount collected is insignificant.

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[8]While the tenant may be legally required to pay rent only for the main crop, in actual practice the landowner is often able to force him to pay for other crops as well.

Table 4.29. O&M costs and water charges collected, in Nepal Rupees.

System	Time period	O&M costs in period	Water charge collection in period	Water charge as % of O&M costs
Large irrigation				
Kankai	1982/83	1348199	4992	0.37
NZIDP[a]	82/83-83/84	12560000	313500	2.50
Medium irrigation				
Manusmara	80/81-82/83	1523270	4859	0.32
Hardinath	81/82-83/84	826756	58866	7.10
Jhanj	79/80-82/83	1708827	322405	18.90
Patharaiya	80/81-82/83	1450050	174587	12.00
Tube well				
FIWUD	81/82-83/84	1236857	99108	8.00
NZIDP[a]	1983/84	3482600	128295	3.70

[a]Narayani Zone Irrigation Development Project.
Source: Shrestha et al. (1984).

To measure how effective the irrigation system's management has been in collecting fees requires a comparison of the amount of fees collected to the amount that should have been collected (i.e., the assessment).[9] These figures for several systems for the past few years are presented in Table 4.30.

Table 4.30. Irrigation service fees assessed and collected, in Nepal Rupees.

System	Year	Assessments	Collections	% collected
Chitwan	80/81	245928	9342	4.00
	81/82	229719	28529	12.00
	82/83	227456	118179	52.00
Manusmara	80/81	149669	2174	1.50
	81/82	153653	1893	1.20
	82/83	173712	792	0.50
Jhanj	80/81	250000	50479	20.20
	81/82	250000	14259	5.70
	82/83	250000	67864	27.10
	83/84	250000	70282	28.10
Hardinath	81/82	103982	15005	14.40
	82/83	83586	10520	12.60
	83/84	110482	34338	31.10

[9]This assumes that the assessment was done properly. According to P. Pradhan (1985) the assessment records are often not up-to-date which calls into question their accuracy.

(Continued)

System	Year	Assessments	Collections	% collected
NZIDP[a]	77/78	104100	7145	6.90
Surface	78/79	318300	5156	1.60
	79/80	293900	2581	0.90
	80/81	659700	122	0.02
	81/82	1381800	-	-
	82/83	1771800	102433	5.80
	83/84	2422900	211277	8.70
	84/85	n.a.[b]	229417	n.a.
NZIDP[a]	77/78	46000	41777	90.80
Tube well	78/79	63600	59526	93.60
	79/80	18500	15878	85.80
	80/81	92500	61210	66.20
	81/82	79200	57140	72.10
	82/83	154000	131214	85.20
	83/84	173200	96500	55.70
	84/85	173200	131008	75.70

[a]Narayani Zone Irrigation Development Project.

[b]Not available.

Sources: Chitwan - Water and Energy Commission (1983); Manusmara, Jhanj, and Hardinath — Shrestha et al. (1984). Narayani Zone Irrigation Development Project, surface — Unpublished records of Water Utilization and Water Collection Unit, Narayani Zone Irrigation Development Project (from an interview in 1985). Narayani Zone Irrigation Development Project, tube well — Nippon Koei (1984).

In all the systems, with the exception of the Tube Well Irrigation Project of the Narayani Zone Irrigation Development Project, the percentage of assessments that is collected is very low, but in most of them there has been some improvement over time. The Tube Well Irrigation Project was able to achieve much higher collection rates than the surface irrigation systems, probably because it is able to exercise much more control over water delivery. The relatively small figure for total charges assessed in the Chitwan System suggests that the assessment was not properly made or was incomplete. At NRs 60/ha, the assessment in 1982-1983 represented irrigation service to only 3,790 ha. This is less than the area irrigated by some of the pre-existing systems which are being incorporated into the Chitwan System (Water and Energy Commission 1983).

Farmers in surface irrigation systems have little incentive to pay the irrigation service fee. There is no relationship between the payment of fees and the quality of O&M in the system.[10] Fees that are collected are deposited in the consolidated fund of the central treasury of the government. Funds collected in a given system are not earmarked for expenditure in that particular system. All systems are subject to the same basic budgetary procedure, and budget allocations are not influenced by the level of fee collection in the systems.

[10]While the rate of fee payment does not affect the quality of the O&M in the system, the quality of O&M likely influences the payment of the charges. As mentioned above, farmers indicated a willingness to pay the fees if there is timely and reliable irrigation service provided (Shrestha et al. 1984), and the General Manager of the Narayani Zone Irrigation Development Project said that if he consistently received the agreed-upon delivery of water from India in the Nepal East Canal, he could increase the rate of fee collection because of providing better irrigation (personal communication, 1985).

In tube well irrigation systems the supply of irrigation water can be cut off in response to nonpayment of fees. This provides the system managers with an effective penalty to impose in the event of nonpayment. In general, the penalty rule has not been effective in surface irrigation systems. The existing rule calls for auctioning of a part of the land owned by the nonpaying farmer, in proportion to the amount due to be paid. Auctioning a part of the land instead of the whole parcel of land poses problems in implementation, and depriving a farmer of his land is an extremely harsh penalty which is rarely if ever implemented. As a rule, irrigation project offices forward to the Office of the District Land Administration the names of farmers who have outstanding water charge assessments. Because all dues must be paid to the government prior to any transaction involving land, farmers who want to sell land are forced to settle their obligations. As property transactions are, however, relatively scarce, this regulation is not an effective enforcement measure.

In 1985 DIHM proposed a set of irrigation rules and regulations which would place a great deal of emphasis on the collection of irrigation service fees, including incentives for payment and penalties for failure to pay. The fee would be paid once a year, and the rate would be determined on the basis of the area of land, the nature of the soil, the volume of water available in the canal, and the reason for using water. The draft rules say nothing concerning the level of fees to be charged. They would be paid in mid-April each year, irrespective of the number of crops raised in the year. A five percent rebate would be granted to those who pay by mid-February. If the water users' group assisted in the collection of the fees, it would be allowed to retain three percent of the amount collected.

The proposed regulations place considerable emphasis on penalties for failure to pay. If payment is late by not more than 1 month, a penalty of 5-10 percent of the fee would be imposed. If payment is more than one month but less than two months late, an additional five percent penalty would be charged. If the amount is still not paid within two months after the due date, it would be recorded as an account outstanding. The irrigation officer would be authorized to seal off the outlet to land farmed by persons who have not paid the water charge until the outstanding amounts have been collected. In the event of nonpayment of either the irrigation service fee or fines imposed for failure to observe the rules and regulations established for the security of the irrigation system, either movable or immovable assets would be seized and auctioned for realization of the amount due. A standing crop could be harvested and sold for payment of the amount due.

Each irrigation system would have a section for collection of irrigation service fees, and this section would send out mobile teams to collect outstanding fees and fines. Judging from the experience in the Chitwan System, this in itself may significantly increase the rate of collection; but it will also increase the cost of collecting fees.

Farmer-managed systems sometimes collect fees from the farmers to make specific improvements (Martin and Yoder 1983, P. Pradhan 1983). Cash is most often used to purchase cement and sometimes to pay skilled tunnel diggers or masons. The assessment rates are fixed in each case according to the amount of cash that must be raised to complete the work. Individual farmers are assessed in proportion to the amount of their water allocation. For instance, if a farmer is entitled to five percent of the water in the system, he will be assessed five percent of the total amount to be raised. Farmer-managed systems also regularly impose fines on members for being absent when

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required to participate in maintenance work on the system. The organizations are very successful in collecting the full amount of fees and fines that are charged. The membership brings social and, sometimes, physical pressure to bear on members who refuse to pay. An example was reported of members of one system taking the cooking utensils of a farmer who had refused to pay and threatening to sell them to realize the amount due. He paid the amount, and all the members were made aware of the organization's determination to collect all assessments. Sometimes one or two members will be appointed to collect the dues from members and be given a percentage of the amount collected as remuneration for their efforts in collection.

Collection costs. Very little detailed information is available on the cost of irrigation fee collection. Some information has been reported for the Narayani Zone Irrigation Development Project by P. Pradhan (1985). In 1982, a Water Utilization and Water Charge Collection Unit was established in the project office. This unit has a total of 9 employees with annual salaries totaling NRs 59,520. In addition there are field staff (two surveyors and one assistant accountant) in each of the six blocks of the system for collection of irrigation service fees. The total annual cost of these field staff is NRs 146,160 (NRs 24,360/block). In fiscal year 1984/85, a total of NRs 204,577 in water charges was collected in the Stage-I Surface Irrigation System of the Narayani Zone Irrigation Development Project. The salaries of the field staff alone amounted to 71 percent of the amount collected.

For water charge collection in the Deep Tube Well Irrigation System of the Narayani Zone Irrigation Development Project, three surveyors, three assistant accountants, and one peon are employed. Their annual salaries total NRs 56,280. Fees collected in the tube well irrigation system totaled NRs 131,138 in 1984/85. The salaries of the staff directly involved in collecting these charges amounted to 43 percent of the total collected. If the salaries of the staff in the Water Utilization and Water Charge Collection Unit in the project office are included, the collection of a total of NRs 335,715 in water charges in the Narayani Zone Irrigation Development Project in 1984/85 cost NRs 261,960 in salaries alone. There were certainly additional costs including transportation, allowances, supplies, and depreciation on offices and equipment. The net contribution of water charges toward the cost of O&M is, thus, extremely low.

Indirect Methods

There are several additional fiscal instruments which raise money indirectly from the beneficiaries of irrigation. Land is taxed at different rates depending upon whether or not it is irrigated. Both the absolute level of rates and the relative difference between the tax on irrigated and nonirrigated land are very low. In the hills the best irrigated land is taxed at a rate of NRs 20-40/ha per year, while the tax rate for nonirrigated land is NRs 5-20/ha per year. In the Tarai the tax on irrigated land is approximately NRs 79/ha per year, while nonirrigated land is taxed at a rate of NRs 42-68/ha per year. If it is assumed that the average tax rate for irrigated land in the hills is NRs 30/ha and for nonirrigated land, NRs 12.50/ha, then the annual tax revenue due to irrigation from 178,000 ha of irrigated land in the hills is NRs 3,115,000. Assuming an average tax rate on nonirrigated land in the Tarai of NRs 55/ha, the net land tax revenue due to irrigation of 466,000 ha of Tarai area would be

NRs 11,184,000/year. Most of this revenue due to irrigation, however is from systems that were developed and are managed by farmers. Using the estimates of area irrigated by farmer-managed and government-managed systems in Table 4.3, approximately 70 percent of the incremental land tax revenue due to irrigation comes from farmer-managed irrigation systems.

The nearly NRs 14 million in potential land tax revenue that could be attributed to irrigation exceeds by a factor of more than 10 the revenues raised directly from water charges. It is unlikely, however, that irrigation has resulted in this much additional tax revenue. Changes in classification of the land after the construction of an irrigation system are not made as soon as the facility is in place. A more detailed analysis of how much land falls into each classification would be required to determine the amount of land taxed at the higher rates levied on irrigated land.

The Nepal Food Corporation distributes food grain in Kathmandu and to deficit areas in the country at controlled prices. Part of the food which it distributes is acquired at concessionary prices from exporters and millers. In the past, as a condition for traders in the export market to be allotted a share of the export quota, a levy was applied to the quota requiring them to sell to the Corporation, at a predetermined low price, a percentage of the amount exported. In 1975/76, procurement under this levy constituted 98 percent of the Corporation's total grain procurement, but by 1980/81 accounted for only 15 percent. The amount of the levy, as a percentage of exports, has also changed over time. The policy since 1980 has been to impose no levy on exports to India and only 10 percent on grains exported to other countries. The proportions of levy on exports and the price of rice procured under the levy from 1975 to 1984 are shown in Table 4.31. The levy price amounts to approximately 50 percent of the retail price charged by the Nepal Food Corporation (Rawal and Hamal 1984). A one percent sales tax is also charged on grain that is exported.

Because the levy on exports in effect sets aside a quantity of rice for the NFC to procure at a price which is below the free market price, it is the equivalent of a tax on exporters of rice. The incidence of the tax depends on the extent to which the burden is passed on to the farmers. Karki and Neupane (1984) assert that it has had a depressive effect on the market price in the Tarai, suggesting that exporters have been successful at passing the burden to the farmer.

As Table 4.31 shows, the percentage of grain exported that must be sold to the Nepal Food Corporation at the levy price is declining, with the result that the Corporation acquired much less grain at the reduced price for its distribution program. Consequently, a production levy was introduced in 1982/83. Large-scale rice millers (i.e., those with a milling capacity of at least 2 tons of rice per hour), are required to sell to the Corporation, 30 percent of the grain they mill, at a levy price. This price is usually the market price during the harvest time in October-November when prices are generally low. In the lean months of June-July sales are at prices usually lower than the prevailing market prices. For 1983/84 and 1984/85, the production levy was reduced from 30 percent to 25 and to 10 percent respectively. Purchases under the production levy program were placed by the Corporation at 20,000 tons in 1982/83, another 20,000 tons in 1983/84, and roughly 10,000 tons in 1984/85. The effects of the production levy and its incidence are similar to those of the export levy.

Table 4.31. Rates of levy on export and levy prices of rice, 1975 to 1984.

Rates of levy on export	
Mid-February to mid-May 1975	25%
Mid-May to fourth week of February 1976	30%
Fourth week of February 1976 to mid-November	25%
Mid-November 1980 to 1984	10% on all exports from Nepal, except exports to India on which no levy is applied.
Levy price of rice	
From 1974/75 to mid-November 1980	NRs 139.32/100 kg
Mid-November 1980 to 1984	NRs 200.00/100 kg

Source: Agricultural Projects Services Centre (1984).

RELATIVE CONTRIBUTION OF FARMERS TO IRRIGATION FINANCING

An attempt was made to calculate a cost recovery index for two hypothetical irrigation systems, one with extensive development and the other with intensive development, taking into consideration direct and indirect sources of revenues. Both production and O&M costs were assumed to be greater in the system with intensive development. Table 4.32 presents the results which show total cost recovery indices of nearly 13 percent in both cases. Cost recovery as a percentage of O&M costs was 161 percent in the low investment system and 172 percent in the high investment system.

These figures are hypothetical maximums, and actual cost recovery is considerably less. The calculations assume a 100 percent rate of collection of irrigation service fees, while the percentage of fees actually collected has been seen to be much less. A more realistic assumption would be a collection rate not exceeding 25 percent (i.e., NRs 40 instead of NRs 166). This would reduce the total cost recovery index to 8 percent in the low investment system and 10 percent in the high investment system, and cost recovery as a percentage of O&M cost to 98 and 130 percent, respectively.

The calculation also assumes that the production or millers' levy is applied to the full amount of the incremental production and that 75 percent of the incremental production is legally exported and the export duty paid. In 1984/85 only 10,000 tons of rice were purchased under the levy, indicating that it was applied to only 100,000 tons of rice that was milled. Production in the Tarai was estimated to be more than two million tons. Therefore less than five percent of the production was covered by the levy. At that rate, the revenue from the millers' levy in the calculation would be reduced from NRs 110 to NRs 6 and NRs 270 to NRs 14. This reduction, coupled with the lower rates of fee collection would result in total cost recovery indices of between three and four percent for both systems. Cost recovery as a percentage of O&M expense would drop to 46 for the low investment cases and 44 percent for the high investment cases.

A third assumption is that export tax is paid on 75 percent of the incremental production. The Ministry of Agriculture has estimated that the ratio of unauthorized to authorized rice exports is 2:1. If this is assumed to be the case with the exports from incremental production, the export duty

Table 4.32. Estimated cost recovery indices (maximum and realistic).

Type of system	Extensive development	Intensive development
Maximum		
Annualized capital cost/ha[a]	2000.0	3460.0
Annual O&M cost/ha	200.0	300.0
Total annualized cost (NRs/ha)	2200.0	3760.0
Direct cost recovery (NRs/ha)		
Water charges[b]	166.0	166.0
Indirect cost recovery (NRs/ha)		
Incremental land revenue[c]	24.0	24.0
Miller's levy[d]	110.0	270.0
Export tax[e]	22.0	55.0
Total cost recovery (NRs/ha)	322.0	515.0
Total cost recovery index	14.6%	13.7%
Cost recovery/O&M cost	161.0%	172.0%
Realistic		
Annualized capital cost/ha	2000.0	3460.0
Annual O&M cost/ha	200.0	300.0
Total annualized cost/ha	2200.0	3760.0
Direct cost recovery (NRs/ha)		
Water charges[f]	40.0	40.0
Indirect cost recovery (NRs/ha)		
Incremental land revenue	24.0	24.0
Millers' levy[b]	6.0	14.0
Export tax[c]	7.0	18.0
Total cost recovery (NRs/ha)	77.0	96.0
Total cost recovery index	3.5%	2.5%
Cost recovery/O&M cost	39.0%	32.0%

[a] Assuming a 50-year project life and 10% interest rate.

[b] NRs 100/ha/crop times cropping intensity of 166%

[c] Increase from average Tarai rate for nonirrigated (NRs 55/ha) to rate for irrigated NRs 79/ha.

[d] NRs 1/kg on 10% of incremental rice production due to irrigation, (i.e., 1.1 tons/ha) for extensive development and 2.7 tons/ha for intensive development (Table 4.22, Chandra).

[e] 1% of price of milled rice (NRs 4,500/ton) assuming 75% of increment in rice yield is exported, also assuming 60% milling efficiency.

[f] NRs 100/ha/crop times cropping intensity of 166% and collection rate of 24%.

[g] As in d, but levy covers only 5% of incremental production.

[h] As in e, but assume export tax collected on one-third of rice exported.

revenues would be reduced by two-thirds. Incorporating this rate results in per revenue from export duty of only NRs 7 and NRs 18 in the 2 systems. This reduces the total cost recovery index to 3 percent in the low investment system and 2 percent in the high investment system and cost recovery as a percentage of O&M expense to 39 and 32 percent, respectively. The second half of Table 4.32 presents the calculation which incorporates these more reasonable assumptions under current conditions.

Farmers' participation in irrigation management. When one considers the entire irrigation sector in Nepal, one must conclude that farmers bear a large share of the cost of providing irrigation services simply because more than 70 percent of the irrigated area is served by systems which have been developed and are managed by farmers. It is only in the past 30 years that the government has been significantly involved in irrigation development. Only in the past 15 years, with large infusions of foreign aid for the construction of large-scale new systems, has the O&M of government irrigation systems become a matter of concern.

Considering the general scarcity of resources and the difficulty of mobilizing resources internally, it would not be possible to irrigate nearly the area that is now being irrigated, were it not for the large amount of irrigation which is wholly farmer-managed. It would seem desirable to use this resource as far as possible as a supplement to the increasing amounts of central government resources that are being invested in the development of irrigation systems. The government must be more involved in the construction of irrigation systems because, for the most part, the areas that remain to be developed are technically more difficult than those already developed by farmers. Construction of systems that would fully use the larger rivers in the Tarai is generally beyond the technical and financial capacity of farmer groups.[11]

There is, however, considerable scope to expand the area that is irrigated under farmer-management through a) investments to enable the expansion of the area served by existing farmer-managed irrigation systems, and b) turning over of government-built systems to farmer organizations to operate and maintain. The latter would be particularly true of groundwater systems, but could also be done with all of the government-developed hill irrigation systems as well as some of those in the Tarai. In order to do this, a participatory development approach would be required which involves the farmers from the very beginning of the conceptualization of an irrigation system. It would have to be made clear that the system will be operated and maintained primarily by the farmers so that they will not develop a dependency on the government.

There is evidence that with the increasing involvement of the government in irrigation development and management, farmers are becoming less willing to mobilize the amounts of resources for O&M that they have in the past. Farmers in the Kathmandu Valley, observing DIHM managing some systems, have sought to have it take over the O&M of their systems. It was reported that under the Ministry of Panchayat and Local Development program [with the assistance of the International Labor Organization (ILO)] to rehabilitate farmer-managed systems, farmers have resisted reassuming responsibility for system maintenance.[12]

EVALUATION OF FINANCING POLICIES

Nepal's financing policies can be evaluated in terms of efficiency of investment decisions, efficiency of irrigation system management, and equity of resource allocation.

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[11]There are farmer-managed systems on the Tarai which use the major rivers. An example is a confederation of 3 systems which irrigate 15,000 ha in Kailali District. The three organizations work together to divert water from the Karnali River, the largest in Nepal.

[12]Personal communication, Louis Rijk, ILO Project Manager, 1982.

Efficiency of Investment

Investment decisions will be most efficient in an economic sense if the decision makers are the same persons who will receive the bulk of the direct benefits and bear the majority of the costs of the investment. The farmers, who are the major direct beneficiaries, are in principle responsible to repay very little of the cost of construction of an irrigation system. In practice, given the very low rates of water charge collection, they repay none of the investment costs in systems constructed by DIHM, the primary government irrigation development agency. The ability of the farmers to repay the cost of investment is not a factor in irrigation investment decisions with the exception of systems financed by loans to the farmers by the Agricultural Development Bank of Nepal. FIWUD requires farmers to pay 25 percent of the construction cost. Investment decisions are more a function of the amount of budget available which, in turn, is largely determined by the international lending and donor agencies. To satisfy these agencies, systems for investment must meet certain minimum standards of economic efficiency. Feasibility studies always include an estimate of the economic efficiency of the system, but given the weak database and the assumptions that must be made, these at best would weed out the most unattractive systems.

Efficiency of System Management

The efficiency of system management is largely a function of the adequacy of the O&M. It is generally assumed that if the managers of a system are financially accountable to the users of it, the system will be managed more efficiently than if there is no such accountability. The present procedures for financing O&M do not provide this kind of accountability. O&M budgets are drawn up by DIHM and submitted to the Ministry of Finance which determines the amount of resources to allocate for irrigation system O&M. Farmers have no input in the process. Water charges which are collected are deposited in the general treasury and are not designated for expenditure in the system from which they were collected. There is no link between the amount of water charges collected and the size of the O&M budget for a particular system or for the sector as a whole. Farmers, thus, cannot affect the managers of the system or the amount of resources available for O&M of the system through their decisions on whether or not to pay the irrigation fees.

Efficiency of Water Use

The method of charging for irrigation services does not promote efficiency of water use. It has been argued that assessing a water charge makes the farmers aware that water is not a free good and that they will, thus, be more careful and efficient in their use of water. Charging for water *per se*, however, does not accomplish this. On the contrary, charging a flat fee per hectare irrespective of the amount of water used or the crop grown or both, may have more of a tendency to promote wasteful use of water. The marginal costs to the farmer of using additional water are zero, in terms of the water charges, while there are positive marginal benefits up to a certain level of water use.

Income Distribution

The bulk of the government-operated irrigation in Nepal is constructed and managed by DIHM. Construction is financed by the general treasury, largely through grants and loans from donor agencies, the Asian Development Bank, and the World Bank. Hypothetical analysis has shown that even under optimistic assumptions concerning the payment of water charges, the millers' levy, export tax and land tax, the percentage of capital cost recovered by the government is extremely low. The actual rate of farmers' payment of water charges results in no recovery of capital costs and only a low level of farmer payment for O&M in government irrigation systems.

To the extent that irrigation services are financed from the general treasury, there is a transfer of income from taxpayers to farmers. This is generally a redistribution of income from the urban population to the farmers. To the extent that revenues from land taxes help to finance the government irrigation systems, there is a transfer from farmers without irrigation and from those who, with their own resources, completely manage their own irrigation systems, to farmers with land in government systems.

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