Financing Irrigation Services: A Literature Review and Selected Case Studies from Asia

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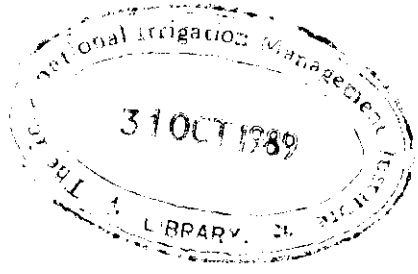

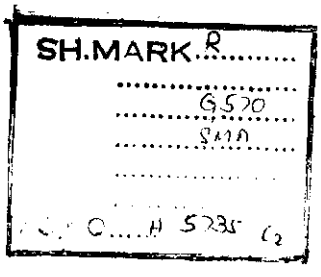

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PREFACE

Studies on the financing of recurring costs of irrigation systems are important to governments, international financing agencies, and the International Irrigation Management Institute (IIMI) because of the difficulties currently experienced throughout the world in operating and maintaining systems adequately. Poor irrigation system operation and maintenance (O&M) is in part a result of insufficient allocation of resources. The past several decades have seen huge investments in irrigation infrastructure development, but budgets for the O&M of systems have not increased in proportion to the increase in irrigated area. Irrigation agencies which are unable to finance adequately the most basic O&M practices cannot implement recommendations for improved management.

The studies which are published in this volume were undertaken by IIMI and its collaborators in 1985 and 1986. The volume begins with a review of the literature on irrigation financing and includes chapters on irrigation financing policies and practices in Indonesia, Korea, Nepal, the Philippines, and the Indian states of Bihar and Haryana. An annex to the chapter on Korea presents an historical review of the Korean policies which have resulted in the development of the financially autonomous Farmland Improvement Associations (FLIA). The set of countries considered in the studies represents several different types of institutional arrangements: decentralized, financially autonomous (Korea, Indonesia — tertiary level); centralized, financially autonomous (the Philippines); and centralized, financially dependent (Nepal, Indonesia — main system level, Bihar, and Haryana).

The studies conclude that the quality of irrigation system O&M is affected not only by the amount of resources made available to operate and maintain systems, but also by the institutional arrangements under which they are provided. It is important that an agency responsible for O&M — and its staff — be given appropriate incentives to achieve improved, cost-effective management of irrigation facilities. Financially autonomous agencies, dependent for a significant portion of their revenues on farmers' payment of irrigation service fees, have a greater incentive to provide good irrigation service than do financially dependent agencies that receive their budget from the national treasury.

Most financing mechanisms employed in the study countries do not promote efficient investment decisions nor efficient use of water. For a financing mechanism to improve investment decisions, an institutional linkage is needed between the investment decision process and the financial viability of agencies (both national and international) responsible for investment decisions. In most institutional settings, this condition is lacking.

In Korea there are clear linkages between investment costs and the level of irrigaton service fees, but it is difficult to determine whether these linkages have an influence on the efficiency of investment decisions. There is evidence from the National Irrigation Administration's (NIA) program to rehabilitate communal irrigation systems in the Philippines which shows that requiring farmers to repay the cost of investment and giving them a say in the planning and implementation of projects results in a reduction in costs. Also, in the Philippines, a policy making the NIA responsible for repayment of foreign loans has caused the agency to reconsider the desirability of undertaking new construction involving such loans.

Water pricing, requiring volumetric measurement of water and the ability to turn supply on or off at farmers' requests, can influence farmers' water use decisions. However, this requires a higher degree of physical control over distribution of water than is typically found in systems in the countries considered in the IIMI studies. Water pricing is generally not found in irrigation systems characterized by large numbers of small farms on which rice is a predominant crop, as under such conditions water pricing is difficult to implement and costly to administer.

The principal direct financing mechanism observed in the study countries involves irrigation service fees charged at a flat rate per unit area, sometimes differentiated to account for factors such as cropping intensity and type of crop. These area-based fees, rather than promoting efficient water use, generally provide incentives for overuse of water by those farmers able to obtain it.

Another important conclusion of the studies is that, under conditions of reasonable irrigation service, the incremental benefits derived by farmers from irrigation will be adequate to make it possible for them to pay the full cost of O&M while still retaining significant increases in net incomes due to irrigation. However, the benefits of irrigation are typically not great enough to permit the full recovery of O&M plus full capital costs from the water users. The literature review also showed that throughout the world, government-assisted irrigation projects involve large subsidies for capital costs.

The proportion of the cost of irrigation covered by farmers' payments of irrigation service fees depends on the amount of the fee and the proportion of assessed fees that are actually collected. In Korea, the combination of high fees and a collection rate of nearly 98 percent results in approximately 93 percent of the cost of O&M being recovered from farmers. Farmers' payments covered an estimated 78 percent of the cost of O&M in the Philippines. For Nepal, the fee rate was estimated to be only 60 percent of the cost of O&M, and the low collection rate results in only about 10 percent of the cost of O&M being paid by farmers. In the case of Bihar, it appears that the cost of collecting irrigation service fees exceeds the amount paid by farmers due to low fees and rate of collection.

Secondary income is a frequently overlooked but important source of financing for irrigation agencies. In Korea, secondary income from interest on deposits, sale of fishing rights in reservoirs, and sale of water for nonagricultural uses accounts for approximately 25 percent of the revenues of the FLIAs. NIA in the Philippines also earns significant secondary income from equipment rental, interest on its corporate fund, and management fees charged for supervising foreign-funded projects. Secondary income is also important in many local water users' organizations in Indonesia, and in many other places in the world, including Taiwan, China, southern India, and the United States.

Dr. Leslie E. Small was the IIMI project leader responsible for the literature review, development of the study framework and methodology, much of the data collection, and is co-author of the Indonesia, Korea, and Philippines studies as well as the annex on FLIA in Korea. Dr. Marietta S. Adriano assisted with data collection in Indonesia, Korea, Nepal, and the Philippines, and co-authored the Indonesia, Nepal, and Philippines studies. Dr. Edward E. Martin co-authored the Nepal study and reviewed and assisted in preparation of the other studies. Dr. Prachanda Pradhan assisted with data collection and co-authored the Nepal study. Professor Young Kun Shim provided valuable assistance in collecting data in Korea and co-authored the Korea study and the annex about the history of the development of FLIAs in Korea. Dr. Ramesh Bhatia was commissioned to prepare the study of Bihar and Haryana in India. The assistance of Dr. Effendi Pasandaran in data collection in Indonesia was most helpful.

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Financing Irrigation: A Literature Review

Leslie E. Small

FINANCING IRRIGATION: A LITERATURE REVIEW

IRRIGATION FINANCING AND THE OBJECTIVES OF IRRIGATION DEVELOPMENT

The approaches to irrigation financing need to be understood in relation to the objectives of a nation's irrigation development program. At least four general categories of objectives can be identified: increased national food production (including stabilization of production and "self-sufficiency"), increased production by subsistence farmers (including famine protection), general national or regional development (including land settlement), and generation of increased government revenues.

Increased national food production is an objective underlying irrigation development in many nations. In Bangladesh, a very rapid increase in irrigation was seen as a key element in meeting the primary objective of the medium-term food production plan, namely, "to ensure food security to the nation by achieving food grain self-sufficiency" (Huq 1980:168). Self- sufficiency in rice has also been an important element underlying the irrigation development plans of the Philippines and Indonesia. In Malaysia, the government has used irrigation as a means of increasing the proportion of domestic production in the country's rice consumption. Just as irrigation development is seen as an important component of the strategy for achieving the self-sufficiency objectives of these nations, the irrigation financing mechanisms must also be seen as consistent with these objectives. Any financial mechanism which would limit the planned rate of development and use of irrigation would be deemed unacceptable.

Increasing the income and production of subsistence farmers was one objective underlying the development of irrigation in India and Pakistan during the late 19th and early 20th centuries. Projects which, when judged by a financial productivity criterion, were deemed to be "unproductive" had an important place in the irrigation development program if they would benefit the nation by reducing famine. Such projects might also have some fiscal advantages to the government in the form of reduced expenditures on famine relief (National Council of Applied Economic Research 1959:65). The explicit income distribution objective associated with this policy has clear implications for financing mechanisms. In particular, it would be inconsistent to use a mechanism requiring the water users to pay for the full cost of the development and operation of the irrigation system.

Regional development, often including land settlement, has been an important objective of irrigation in many countries. Much of Sri Lanka's irrigation development has been in the context of land settlement in the dry zone of that nation. The country's largest irrigation scheme, the Mahaweli Project, might best be described as an irrigation-based regional development and land settlement scheme.

In the USA, land settlement and regional development were major objectives underlying the construction of irrigation facilities in the western part of the nation (US National Water Commission 1973:257, US Water Resources Policy Commission 1950:76). Pressure to undertake such projects generally did not stem from farmers or potential settlers; rather, it came from "local chambers of commerce and similar organizations" of businessmen who expected to gain from the indirect benefits of irrigation associated with the development of communities based on agriculture (Teele 1926:439; US Water Resources Policy Commission 1950:172). Thus, for example in 1899, ... "[T]he National Irrigation Association was organized by railroad officials, manufacturers, businessmen, and others interested in the development of irrigation" (US Water Resources Policy Commission 1950:151). As a result of these objectives, it has been argued that it is inappropriate for the entire financial burden of irrigation to be borne solely by the farmers . ... "[T]he argument for all public participation in reclamation [i.e., irrigation] is the claim that a great public benefit arises from the reclamation of arid lands. If such is the case, the question arises whether the water users should be expected to repay the whole cost" (Teele 1926:439).

Increasing government revenues was one of the two major objectives of irrigation development in India and Pakistan during the late 19th and early 20th centuries. In selecting irrigation projects to achieve this objective, a productivity criterion was used. The criterion required that a "productive" irrigation project show, by the tenth year, a certain percentage expected return (in terms of net government revenues from irrigation fees) on the initial capital cost, including interest (National Council of Applied Economic Research 1959:65, Prasad and Rao 1985). Investment in "productive" irrigation works thus had an objective similar to that which governs investment in a profit-motivated private sector. This has obvious implications for the types of financing mechanisms that would be appropriate.

INSTITUTIONAL ARRANGEMENTS

The effects of financing policies depend on the organization of responsibilities for the four processes of 1) allocating resources to irrigation, 2) using these resources to implement irrigation services, 3) obtaining resources from irrigation beneficiaries, and 4) controlling the resources obtained from the beneficiaries. The key distinction is between situations of full or partial *financial autonomy* and those of *financial dependence*. With financial autonomy, an irrigation agency has at least partial responsibility for all four processes. In particular, it has control over the resources which it obtains from the water users, and thereby over the allocation of all or a major portion of the resources devoted to irrigation operation and maintenance (O&M). Financial autonomy may involve either decentralized implementing agencies or a centralized irrigation agency. With financial dependence, an irrigation agency has no control over any funds collected from the water users, and is thus dependent on resources allocated to it through the general government budgetary process.

Decentralized financial autonomy can be found in a number of countries where control of irrigation operations is vested in local irrigation districts (USA, Mexico, China), companies (France), land improvement districts (Japan), farmland improvement associations (Korea), irrigation associations (Taiwan), or irrigation cooperatives (Greece). In China, for example, irrigation districts are, in

principle, supposed to be able to sustain irrigation operations without reliance on external subsidies (Nickum 1982:iii). In practice, however, many subsidies are provided by the government, even for normal O&M activities (Nickum 1982:4,35). In Mexico and the USA, localized irrigation districts are financially autonomous within the structure of government rules and regulations that provide for subsidies for initial construction (Adams 1952; US Congress, Office of Technology Assessment 1983; Olaiza-Perez 1986). A similar situation exists for irrigation companies in France (Bergmann 1984, Pelissier 1968) and for irrigation cooperatives in Greece (Bergmann 1984). Essentially the same can be said for the land improvement districts in Japan (Okamoto et al. 1985, Kimura 1977, Kelly 1982). Irrigation Associations in Taiwan follow a similar pattern (Bottrall 1978b, Abel 1976), although there may be more direct government supervision and control of activities than in the cases of the countries mentioned previously. The situation in Korea is similar to that in Taiwan, with financially autonomous Farmland Improvement Associations responsible for operating the irrigation facilities, but under fairly close supervision through the provincial government and through the Ministry of Agriculture and Fisheries.

In almost all countries with decentralized, financially autonomous irrigation institutions, there are substantial subsidies which the irrigation agencies receive from the central government. In some cases the nature of the subsidies is fairly clearly defined, so that within the framework of regulations associated with these subsidies, the individual irrigation agencies show a high degree of financial autonomy. In other cases, however, either the magnitude of the subsidy is so large (covering portions of normal O&M as well as capital costs) or the procedures whereby the subsidies are determined are so politically motivated that the irrigation agencies may have very little financial autonomy. One brief report in the literature suggests that this latter situation may prevail in Italy (Bergmann 1984).

One of the potential advantages of decentralized financial autonomy is that it may create financial accountability linkages between the managers of irrigation projects and the water users. It is reported, for example, that irrigation districts in China, unlike most economic enterprises in the state sector, are not overstaffed. The reason given for this is that the arrangement whereby the revenue of the district comes from the water users provides an incentive to limit the number of personnel (Nickum 1982:22). There is also evidence that water users in China use the threat of nonpayment of water fees as a means of leverage over management (Nickum 1982:38).

On the other hand, cases are reported where decentralized financial autonomy results in a vicious circle of low fee collection, leading to inadequate budget for O&M, leading to poor quality O&M, leading to low ability to pay and to low rates of fee collection. This appears to have been a problem with some of the small pumping projects in China (Nickum 1982:27).

Centralized irrigation agencies may also be financially autonomous, although this appears to be relatively uncommon. The most notable example occurs in the Philippines, where a semigovernmental corporation, the National Irrigation Administration, is responsible for the construction and operation of national irrigation systems throughout the country. Although it has in the past received substantial funding through government subscription of capital, it is increasingly being forced to conduct its operations within the budget constraints of the revenues which it can earn from its corporate activities. It seems quite clear that the increased financial autonomy of the National

Irrigation Administration has been a driving force in modifications of the financial procedures for O&M of irrigation projects in the Philippines. In particular, much more attention is now given to fee collection from water users, and efforts have been undertaken to establish systems of incentives to increase the rates of fee collection.

A common alternative financial arrangement is that of financial dependence, whereby a government line agency responsible for operating irrigation projects depends solely or primarily on government budgetary procedures for its revenues. This approach prevails in a number of countries including Nepal, Thailand, Indonesia, and India (Bottrall 1976, Pawar 1985), Pakistan (Wolf 1985, Bottrall 1978a), Sri Lanka (Silva et al. 1985), and Bangladesh (Khan 1981). One feature of this approach is that the amount of water charges collected from farmers has little or no relationship to the amount of funds which is made available for the O&M of the irrigation systems.

PRINCIPLES FOR ASSESSMENT OF FINANCIAL OBLIGATIONS

Assessment of financial obligations is usually based on either the cost or the benefit principle. Although these approaches are conceptually distinct, financing policies developed in any given country may incorporate a mixture of the two.

When the cost approach is used, it is common for the government to provide subsidies that cover some specified portion of the irrigation costs. Typically, the subsidy involves a portion of the capital costs (either for initial construction or for major upgrading or rehabilitation), but no portion of the O&M costs. In France, for example, it is reported that the range of the explicit subsidies was 20-60 percent of the capital costs. In addition, an implicit subsidy exists in the form of low-interest loans available to the farmers to cover the remaining portion of the capital costs (Pelissier 1968). Japan also follows a cost approach with varying levels of subsidies from the central and prefectural governments (Kimura 1977). Similar arrangements are found in Taiwan (Bottrall 1978b) and Korea. In the USA, irrigators are obligated to repay the full cost of irrigation construction, but only over periods of 40-50 years at no interest (US Water and Power Service 1980). The average effective subsidy resulting from the application of this policy has been calculated to be equivalent to 81 percent of total (both capital and recurrent) costs of irrigation (US Congress, Congressional Budget Office 1983).

The cost principle is sometimes modified to accommodate considerations related to the amount of benefits received. In the USA the cost principle, which was originally specified in the 1902 legislation providing for the federal government to engage in the construction of irrigation projects, was modified in 1939 to incorporate explicit considerations of ability of the irrigators to pay from the benefits derived from irrigation (US Congress, Office of Technology Assessment 1983). The net effect is that the total nominal amount which farmers are required to repay is determined on the basis of cost, but the amount which is actually paid in any given year is determined on the basis of benefits received.

Considerations of ability to pay also appear to have been incorporated into policies on water charges in Taiwan and Korea. In Taiwan, for example, the government has set a maximum amount which

farmers can be charged for water by the irrigation associations. In some cases, if the costs of the irrigation association cannot be met by these maximum charges, special subsidies may be provided by the government (Taichung Irrigation Association 1985). In Korea, ceilings are placed on the maximum amounts which farmers can be charged for the capital cost of new projects and for their O&M.

There are a number of problems with the application of the cost principle. It has been argued, for example, that because of corruption, inefficiency, and other "leakages," officially reported cost figures for irrigation in India may be as much as double the appropriate or "real" level that users should be expected to repay (Prasad and Rao 1985). Furthermore, for a variety of reasons, projects with very high "real" costs may be built, even though farmers would be unable to pay for their full costs. It has been argued, for example, that very few, if any, of the irrigation projects built in the western part of the USA since 1960 can be justified on rigorous economic efficiency grounds (Young 1978).

Basing financial obligations on levels of benefits received is common in many countries. Under the commune system in China, some of the construction work on irrigation projects was financed by direct labor quotas placed on the production teams. It has been reported that the allocation of these labor quotas to production teams was on the basis of expected benefits from the project (Nickum 1979). In Bangladesh, subsequent to 1976, a water charge equal to three percent of incremental gross benefits was supposed to be levied on projects implemented by the Bangladesh Water Development Board (Khan 1981), and in a large number of countries, financial obligations of farmers are directly related to the size of the area being irrigated.

The benefit principle is consistent with financing mechanisms that place some financial obligations on indirect beneficiaries of irrigation. Few examples, however, of such mechanisms are reported in the literature. In the USA, some irrigation development and operation are financed from assessments made against land in irrigation districts. In California, urban land may be included in these districts as long as this land is deemed to have benefited from irrigation (Adams 1952). It has also been argued that in the USA the use of public revenues to pay for part of the cost of irrigation is justified to the extent that public benefits accrue from irrigation (US Water Resources Policy Commission 1950). In India, it is reported that betterment levies have been tried in various states, although without much success (Braibanti and Spengler 1963, Gandhi 1966). The concept is to help finance irrigation by using some of the windfall private benefits which were created at public expense.

TYPES OF FINANCING METHODS

Earmarked charges levied on the water users. Earmarking of funds collected from user charges for O&M occurs in virtually all situations where decentralized financial autonomy prevails. Thus, for example, revenues from water charges in China are handled as earmarked funds, rather than being treated as financial income that could be used on nonwater expenditures (Nickum 1982). Many irrigation districts in the USA rely on direct charges for water to provide the revenues necessary both to operate and maintain the irrigation systems, and to meet any obligations with respect to the provision for a return on the initial investment (Teele 1927b:130-131, Revesz and Marks 1981, Hutchins 1923).

Benefit taxation of direct beneficiaries. Efforts to impose benefit taxes on the direct beneficiaries of irrigation generally involve taxes on irrigated land, including land-betterment levies. The rationale for this type of financing arrangement is that the direct benefits of irrigation are capitalized into land values. Capturing a portion of these increased land values is a possible alternative to the use of irrigation service fees or water prices for obtaining funds from the direct beneficiaries. Some of the irrigation districts in the USA finance part of their irrigation activities in this fashion (Adams 1952, Hutchins 1923).

Sale of water rights. Some irrigation developments have been financed through the sale of perpetual rights for water. In the USA, for example, such sales have been designed to cover the cost of the construction of irrigation facilities (Mead 1903). The allocation and implicit sale of water rights through those who develop a communal irrigation system in Nepal have also been reported (Martin and Yoder 1983).

Indirect methods of financing. In some countries, funds for irrigation services are provided directly from the government budget. The government budgetary process itself can be thought of as a method of irrigation financing. But in addition, it is useful to consider the various indirect ways that a government may obtain revenues related to the benefits created by irrigation. Four common indirect financing methods are secondary income for irrigation agencies, output price and marketing policies, taxes on agricultural inputs, and general taxes.

In some countries, local irrigation agencies have sources of income other than water charges. These sources of *secondary income* may also be used to finance irrigation activities. For example, irrigation districts in China may undertake sideline economic activities which generate income that is then used to finance irrigation services (Nickum 1982:4). Some irrigation associations in Taiwan located in urbanizing areas have found that the conversion of previously irrigated land into nonagricultural uses has made some of the existing irrigation canals unnecessary. These associations have been able to sell the land on which these canals were located, and to use the proceeds to finance the cost of irrigation services (Taichung Irrigation Association 1985). In the Philippines, part of the funds used to finance O&M activities of the National Irrigation Administration has come from income from secondary sources of income including equipment rental, interest on construction funds received but not yet spent, and a management fee which the National Irrigation Administration charges for its management of the construction of new irrigation projects. In Korea, secondary income from interest earnings, sale of water for nonirrigation purposes, and rental of assets provides, on the average, about one-fourth of the total income of the irrigation associations. In the USA, the formation of Water Users' Associations was encouraged by governmental policy that gave these associations the rights to certain types of secondary income, such as revenues from the leasing of project lands used for grazing and farming, and the profits from project hydropower plants (Thompson 1985).

In some situations, attempts have been made to impose *benefit taxes on the indirect beneficiaries* of irrigation. This approach usually also involves taxation of increased land values. In this case, however, the land which is taxed may not be limited to agricultural land, but may include nonagricultural land whose value has been enhanced because of the increased economic activity associated with irrigation development. This has been done in parts of the USA, where irrigation

districts are permitted to incorporate nonagricultural land within the district, and to levy a tax on the land if the land is deemed to have benefited from an irrigation project.

Government revenues may be enhanced by irrigation as a result of combinations of *pricing and procurement policies for the major crops* produced on the irrigated land. For example, for many years there has been controlled marketing of grain crops in China, which has effectively meant that much of the increase in production from irrigation could be channeled into the hands of the government. Prices at which this product had to be sold to the government were set at a low level (Nickum 1982:36). Low output prices have also been used in Mexico. For many years, rice prices in Thailand have been held well below world-market levels through the imposition of taxes on rice exports. To the extent that irrigation has led to increased exports, it has also led to increases in government revenues from these taxes.

In some cases a government may increase its revenues from irrigation through placing *taxes on inputs* which are complementary to irrigation. The most common example of this involves taxes on fertilizer sales.

The government may increase its revenues from irrigation due to the structure of *general taxes* in the economy. For example, a general land tax based on the productivity of the land should result in increased revenues to the government. Taiwan has this type of land tax, with 26 land productivity categories. Similar taxes are also found in Indonesia and Nepal. There may also be other taxes which are affected by irrigation activity. If an income tax exists, collections may be higher due to the development of irrigation. Special taxes on agricultural processing activities, such as rice milling, may also increase with irrigation.

Nonmonetary methods of financing. In some cases, farmers may be mobilized to undertake some of the construction and maintenance activities associated with the provision of irrigation services. To the extent that this type of unpaid labor is used to provide irrigation services, the services are financed by the direct labor contributions rather than through any mechanism involving flows of cash.

In China, O&M activities have sometimes been undertaken by farmers who are compensated on the basis of work points. This effectively means that there is no net additional financial cost to the irrigation district for these activities (Nickum 1982:3). In Japan, farmers' organizations are formed to mobilize farmers to construct the terminal irrigation system, and to operate and maintain these facilities (Kimura 1977). It is notable that the cost of these terminal facilities may be twice that of constructing the primary and secondary structures (Kimura 1977). Farmers and their local organizations are responsible for O&M of all facilities at the tertiary level and below. In many cases, part of these responsibilities are met in the form of direct contributions of labor.

METHODS OF CHARGING FOR WATER

In the previous section, various methods for financing irrigation services were considered, some of which involved direct charges on the users of irrigation water. This section reviews the experience of different nations with the various methods by which such charges may be imposed.

Volumetric water prices. It appears that there are relatively few places where volumetric water prices are applied. China has reportedly experimented with some volumetric water charges, but the approach has not been widely used (Nickum 1982:40-42). Some systems in France include a volumetric charge as part of a two-part tariff structure (Pelissier 1968). Volumetric pricing can also be found in some systems in Morocco.

In evaluating approaches that charge for water on a volumetric basis, a distinction needs to be made between situations where the basis for the calculation of the water charge is volumetric but the farmer has little or no control over the volume of water received (as is the case of some projects in Morocco), and those situations where individual farmers make decisions on the volume of water to receive (as is true in other projects in Morocco and apparently in France). The latter cases represent situations of true water pricing, comparable to the pricing of other farm inputs, such as fertilizer. The former situation amounts to a special form of an irrigation service fee similar to a flat charge for water per unit of land area.

Time-based water prices. In some cases a price for water is based on the length of time that a person receives water. This method, which appears to be most common with pump projects, is found in some projects in Mexico.

Area-based water charges. Perhaps the most common type of water charge is an irrigation service fee based on the area served by the irrigation system. The simplest form of this type of charge is a uniform fee per unit area of land commanded by the irrigation system. This system is being introduced in Sri Lanka (Silva et al. 1985). A common modification of this simple approach is to adjust the charge to take into account the cropping intensity of the land. Thus there may be a flat fee per unit area for the wet season, and a separate fee for a dry-season crop. This is the typical approach used in the Philippines. Another modification is to adjust the fee to reflect the type of crop grown. This is done with some systems in France (Pelissier 1968), in parts of India (Pawar 1985, Asopa 1977) and Pakistan (Wolf 1985), and the Philippines.

Another adjustment is to modify the charge according to the number of times which the farmer receives irrigation water. This method may be feasible in situations where there are distinct irrigation deliveries, as opposed to more or less continuous delivery of irrigation water. Such a method has been used in some irrigation projects in Mexico.

Other adjustments are also possible. For example, areas served by pump projects in Pakistan are sometimes charged at a higher rate than areas served by gravity systems (Wolf 1985). In Korea, land is generally categorized on the basis of the benefits derived from the construction of the irrigation facilities. Charges are differentiated accordingly. Distinctions are also made on the basis of the costs of the particular irrigation facilities serving different areas.

Two-part charges. In some countries, the charge for water is based on a two-part tariff, comprising a fixed charge and a variable charge. The fixed charge may be in the form of a capacity charge, as in France, where each irrigator may contract for a certain maximum rate of flow (Pelissier 1968). In this case, the variable charge is for the amount of water actually consumed, measured on a

volumetric basis. Alternatively, the fixed charge could make the irrigator eligible for some "normal" or basic supply of water, with the variable charge imposed on amounts of water taken in addition to this basic amount. For example, it has been suggested that in India a fixed charge could be levied for the "normal" number of irrigations, with an additional variable charge for each irrigation in excess of the "normal" number (National Council of Applied Economic Research 1959:85).

In the USA, two-part charges are frequently used. The fixed component is generally an *ad valorem* assessment on the land, which is a benefit tax on property. This fixed charge may be supplemented with a charge for the actual use of water (Adams 1952). In some cases, the fixed charge may entitle the landowner to some fixed quantity of water, which is generally less than what the farmer wishes to use. A variable charge is then applied to additional quantities of water which the farmer decides to purchase (Teele 1927b:19, 130-131).

Water wholesaling. It has sometimes been suggested that volumetric pricing of water, which is difficult to achieve at the individual-farm level in situations where farm sizes are very small, could be achieved if the irrigation agency were to sell water in bulk at some level in the system where the volume of water could be measured and the individual farmers served by the unit to which the bulk delivery was made could be given the responsibility for distribution of the water within the unit. Such a system has been proposed for Mexico, and apparently introduced in one irrigation district with some success. A similar arrangement is also used in some systems in Morocco, although the farmers served by the unit to which the water is delivered may have little control over the volume of water received.

ENFORCEMENT

Enforcement of the rules for water allocation and for payment of charges and taxes is critical to the long-run sustainability of the financing system. Several types of enforcement mechanisms are reported in the literature.

Termination of irrigation services. In some cases, the agency operating the irrigation system will not deliver water to water users who have not paid their obligations. In Mexico it is reported that in some systems, water will not be delivered without a receipt showing that prior payment has been made. In China, violations of water allocation rules may be punished by the cessation of water deliveries to the offending unit, although the extent of such enforcement is not clear (Nickum 1982:5).

A slightly modified form of this penalty has been suggested for the Sardar Sarovar Project in Gujarat, India. Under the proposal, water deliveries would be organized and monitored, not to individual farmers, but to units comprising groups of farmers served by a defined service area. Delivery of the full water allotment to the service area would occur only if the total water bill for the area is fully paid. If payment is not made in full, water deliveries would be reduced in proportion to the percentage of the total unpaid bill (Frederiksen 1985).

Financial penalties imposed by the irrigation agency. In a number of countries, regulations provide for the imposition of fines for improper water use and for failure to make prompt payment of the

financial obligations associated with irrigation. Fines are levied in Mexico for illegal use of water, but are of questionable effectiveness, as they are reportedly less than the value of the water taken. Fines are sometimes imposed in China (Nickum 1982:5). Fines for late payment of water charges in Korea may be imposed, up to a maximum of 15 percent of the amount due.

Legal sanctions. In several countries, legal sanctions for failure to fulfill financial obligations are imposed. In the USA, failure to meet the financial obligations which are levied for irrigation services may lead to foreclosure and sale of the land of the delinquent water user. This is possible where irrigation districts are in existence and water charges are assessments against the value of the land. Failure to pay thus results in a lien on the land (Teele 1926). The United States Federal Government has further required that irrigation districts impose joint liability for the repayment of the construction costs to the federal government. This means that if the district does not fully pay the costs, no landowner within the district can obtain a clear title to his land (Huffman 1953:86). Some irrigation districts in the USA have the power both to require the installation of water meters, and to read them (Revesz and Marks 1981). Incorporated mutual irrigation companies in the USA have the legal ability to enforce payment of obligations by the shareholders, although unlike irrigation districts, they do not have the ability to levy assessments against the land (Revesz and Marks 1981).

Legal sanctions are not always effective. In Sri Lanka, failure to pay the water charges is punishable through legal means, but the difficulties associated with taking court action against numerous small farmers make this sanction of little practical importance. Similar situations prevail in a number of other countries.

Social sanctions. In some countries social sanctions may be an important method of encouraging water users both to obey water allocation rules and to meet their financial obligations. It is reported that despite the existence of fines for illegal water use in Mexico, social sanctions are the key deterrent to illegal water use. Social sanctions against nonpayment of water charges in Korea are reported to be very high (Wade 1982).

CONTROLS ON EXPENDITURES

Generation of revenues is only one aspect of the problem of financing irrigation services. Another equally important aspect is that of controlling expenditures, to make certain that these expenditures are reasonable and desirable within the context of the benefits that they create for the users of the irrigation services.

Information on this aspect of financing irrigation services is relatively sparse. In some cases, evidence of problems created by the lack of controls is reported in the literature. For purposes of exposition, it is convenient to consider controls on O&M expenditures separately from controls on capital costs.

Controls on Expenditures for O&M

In situations of decentralized financial autonomy, there may be local pressures to scrutinize expenditures more carefully than would otherwise be the case. It has already been noted that in

China, the financial autonomy of irrigation districts seems to result in less overstaffing of the professional management agency than is typical for government agencies in China (Nickum 1982:22). It is reported that in Japan, the alignments of terminal-level field ditches have sometimes been modified to reduce O&M expenditures (Kelly 1982:45). It should be noted, however, that this may be partly a response to the availability of government subsidies for new construction and major repairs, and the absence of such subsidies for normal O&M (Kelly 1982:41). It is also reported that local politicians may resist expensive projects designed to modernize terminal facilities because of the unpopularity of the associated requirement of raising water charges (Kelly 1982:47).

In Mexico, where irrigation is also organized on the basis of decentralized financial autonomy, the financial linkage between user charges and funds for O&M appears to exert some degree of control over expenditure. Mexican farmers have reportedly stated that failure to operate the irrigation system in a cost-effective manner makes them unwilling to pay higher irrigation charges. It has also been noted in Mexico that in communally operated irrigation projects (i.e., irrigation units), where the water users are directly responsible for the conduct and financing of O&M, the maintenance is better than in government-run irrigation projects (i.e., irrigation districts), where farmers have little involvement in expenditure control, other than the payment of water fees. This example is of particular interest, because it runs counter to the argument which is sometimes made that if farmers are responsible for determining (and paying for) O&M expenditures, they will fail to maintain the irrigation facilities at a satisfactory level of performance due to short-sighted desires to reduce costs.

Under systems of financial dependence, the control of O&M expenditures is likely to come through some form of assessment of the "requirements" for operating and maintaining various physical structures present in the system. Thus, for example, in Pakistan, the funds allocated by the provincial finance departments for O&M are based on rigid formulae regarding the physical characteristics of the irrigation system (Wolf 1985).

Controls on Capital Expenditures

Controls over capital expenditures appear to be a particularly difficult problem. Institutional linkages between those making capital expenditure decisions and those who will pay for the resulting facilities are typically weak. In the USA, it has been noted that the increasingly costly projects for irrigated land reclamation are beyond the repayment abilities of the water users. This raises the question "as to whether there is any reasonable limit to the extent of Federal investment" (US Water Resources Policy Commission 1950:172). More recently, it has been argued that most of the irrigation projects that have been built in the western part of the USA since 1960 have been uneconomic from a strict economic-efficiency framework (Young 1978). The implication is that either the control over capital expenditure decisions has been inadequate, or the economic-efficiency framework for project evaluation is inadequate.

A contrasting example comes from recent experience with communal projects in the Philippines. In this case, the government made the water users responsible for the repayment of the capital costs of these projects. A contractual arrangement between the association of water users and the National

Irrigation Administration (which provided assistance for the construction of these projects) meant that farmers had to agree in writing to repay the costs which the National Irrigation Administration would incur on their behalf. It soon became apparent that farmers would not sign such agreements without some authority to control costs. It seems clear that in this case, a serious commitment by the users to repay a portion of the capital costs led to a much more careful control over the capital expenditures.

A similar example comes from another small, communally based pump irrigation project in the Philippines. In this case, the farmers were able to reduce the overall expenditures considerably, in part by removing certain structures from the design that were deemed unnecessary. They were also able to reduce the effective costs by substituting locally available materials and labor for more expensive purchased items. As a result, it was found that the loan which the farmers had to take from the government for the construction of this project was only about 58 percent of the amount originally estimated (Svendsen and Lopez 1980:16).

EVALUATION OF EXPERIENCES WITH IRRIGATION FINANCING

Collection Costs

Any method of financing irrigation which involves collection of funds from a large number of individuals will require the expenditure of resources to administer and implement the collection process. In evaluating the overall effectiveness of different financing methods, these costs of collection must be considered. Unfortunately, it is often difficult to determine their magnitude, and one finds relatively little information on them in the literature on irrigation financing.

Data on the costs of collecting water charges in the State of Bihar, India, for the years 1977/1978 through 1981/1982 are presented in a recent paper, along with data on the total amounts collected. In 4 of the 5 years, the costs of collection ranged from 46-84 percent of the total amount collected. In the fifth year, when collections lagged, the cost of collection was 117 percent of the amount collected (Prasad and Rao 1985). Part of the reason for this poor performance is that the total collections ranged from only 11-28 percent of the amounts due. It is obvious that in such a situation, collection of water charges will contribute little to the net resources available to the government.

In the Punjab Irrigation Department of Pakistan, about 15 percent of the work force is assigned as a special revenue group to assess water charges. For 1983/1984, the budget for the expenditures of this group amounted to 6 percent of the total budget of the Irrigation Department, and was equivalent to about 10 percent of the total amount collected from water charges for that year (Wolf 1985, McAnlis et al. 1984). Since the actual collection of water charges (as opposed to their assessment) is undertaken by the Revenue Department, the total cost associated with the collection of water charges is considerably greater than the cost represented by the above figure.

Collection Efficiencies

The amount of funds collected relative to the amounts which are due varies considerably among nations. As noted above, between 1977/1978 and 1981/1982 in Bihar State, India, collections were only 11-28 percent of the amounts due (Prasad and Rao 1985). In one case study done in Pakistan, the rates of collection of water charges ranged between 70 and 86 percent of current assessments. When the amount of assessments in arrears is included in the calculation, the collections amounted to 55-70 percent of the assessments (Bottrall 1978a:49). By contrast, a case study of the Yun Lin Irrigation Association in Taiwan found collections to be about 98 percent of the assessments. It was noted, however, that in the early 1970s collection rates had fallen to about 28 percent, in part due to the inability of farmers to pay the charges, and in part because of farmers' unwillingness to pay owing to unreliable water supplies and poor service (Bottrall 1978b:65).

Quality of Management Performance

There is little concrete evidence in the literature on the relationship between financing methods and management performance. It has been noted that in Pakistan, the nature of the financing mechanisms for irrigation results in the provincial irrigation departments being accountable upward to the provincial governors, rather than downward to the farmers. The result is a situation where the irrigation departments "can be fiscally accountable and fully responsible for their work, and yet have minimal interaction with farmers, who often feel that the irrigation service they receive is not satisfactory" (Wolf 1985:15).

In Taiwan, it appears that the method of financing is such that the managers of the irrigation associations face an incentive structure, which encourages them to manage the system efficiently. This is partly due to the financial autonomy of the irrigation associations, and the resulting importance of high rates of fee collection to preserve the jobs of the staff of the irrigation associations (Abel 1976). As noted above, farmers in one irrigation association who felt they were not receiving good service responded by withholding payments. The fact that such an action was taken, and that it apparently led to subsequent actions to improve service, resulting in very high levels of payments a few years later, suggests that the financial accountability associated with the financing mechanism used in Taiwan has a positive effect on the efficiency of management performance.

In Mexico, government subsidies are available for rehabilitation and deferred maintenance, but not for normal maintenance. This provides an incentive to neglect normal maintenance, in order to put more of the cost burden of providing irrigation services on the central government. This probably results in reduced project performance.

In an evaluation of a large number of irrigation projects, a World Bank study has noted that in general, the best irrigation performance was achieved in projects where 1) the irrigation agencies themselves were responsible for the collection of the financial charges and 2) the funds collected by the irrigation agencies remained with them for use in operating and maintaining the irrigation projects (Duane 1986). These are the key elements of financial autonomy.

Efficiency of Water Use

There is very little precise information in the literature on the relationships between irrigation financing methods and efficiency of water use. Abel (1976) suggests that the incentive structures for both managers and users of water appear compatible with efficient use of water within irrigation systems in Taiwan, but no data on efficiency of water use are presented. For India, it has been noted that in many projects where water allocation procedures result in deliveries to farmers which are substantially less than they need to irrigate their entire holdings, the opportunity cost of water to the farmer is higher than the water rates charged by the government (Prasad and Rao 1985). The presumption is that the incentive for farmers to be efficient in the use of water is provided by the water allocation mechanism, independently of the method of financing irrigation services.

In 1981, the Operations Evaluation Department of the World Bank undertook an evaluation of water management in 26 projects which had been supported by the World Bank. The report concludes that the information available on the relationship between water charges and water use efficiency at the field level is too limited to draw any conclusions on causality. But it concludes that there were factors that were always considerably more important in explaining farmer behavior than the amount of water charges or whether or not water charges were imposed (World Bank 1981:4). In some cases with low or nonexistent charges, other factors caused farmers to fail to adopt irrigated agriculture. This was reported in the case of five lift irrigation projects in Sri Lanka, where farmers paid nothing for the O&M costs. But in a sixth project in Sri Lanka, farmers paid US$50 per hectare (ha) per season, and immediately used the irrigation water and continued to use it at a high rate (World Bank 1981:40). For a project in Iran, it was concluded that due to the irrigation agency's tight control over the farmers, the subsidization of water did not result in any serious misuse of water by the farmers (World Bank 1981:40).

A report of the US National Water Commission (1973) noted a study conducted in the State of California which examined the price responsiveness of demand for irrigation water. The study estimated that a 10 percent increase in the price of water might result in a 6-7 percent decrease in the use of water. The report concluded that "demand for irrigation water is responsive to changes in price and that greater efficiency could be attained in irrigation water use by adoption of a pricing system" (US National Water Commission 1973:256-257). The report goes on to note, however, that many irrigation districts in the USA do not even measure the amount of water delivered to the users, hindering the implementation of such a pricing system.

Efficiency of Investment Decisions

The review of literature suggests little effective use of irrigation water charges as a means of ensuring efficient investment decisions. The generally low level of capital cost recovery in irrigation projects financed by the World Bank has had no apparent dampening effect on the levels of investment in new irrigation. It appears that in many countries, factors other than the levels of cost recovery dominate the investment decisions.

Financing policies related to capital costs of irrigation development frequently appear to be designed in ways that are likely to encourage *inefficient* investment decisions. A common approach is for a subsidy on the capital cost of irrigation, but not on ordinary O&M. It has been noted that in the USA, the existence of such a subsidy may lead irrigators to select an irrigation method which involves a relatively high capital cost but lower O&M costs, even though such a system may be economically inefficient (US National Water Commission 1973:490).

Specialized social and economic objectives such as regional development or enhanced food self-sufficiency may lead to a further severing of any linkage between cost recovery and investment decisions. In the development of irrigation in the western part of the USA, the government initially encouraged private financing (Teele 1927a). But private financing was plagued with problems that led to many bankruptcies, so that many farmers ultimately acquired irrigation facilities at much below their original cost (Huffman 1953:72-73, Teele 1926). Because of these problems, it eventually became almost impossible to obtain funds for irrigation development (Teele 1927b:70).

This situation led to the passage in 1902 of the Reclamation Act which provided for a revolving fund for financing new projects, and a subsidy in the form of long-term interest-free loans for repayment of the capital cost. But this revolving fund quickly "failed to revolve" leading eventually to direct Congressional appropriation of funds for each project (Huffman 1953:83, Thompson 1985).

Over time, the difficulties in meeting repayment schedules under the 1902 Act became increasingly apparent. Meanwhile, the costs of new irrigation projects continued to rise. One observer suggested the need for "the Bureau of Reclamation to appraise adequately and conservatively the benefits from irrigation and to recommend to Congress only those projects for which reasonable repayment plans can be presented" (Joss 1945:167).

The alternative was to accept the idea that irrigation projects would require continuing government subsidies (Huffman 1953:88). Acceptance of this idea was facilitated by arguments on the importance of irrigation as a means to general regional development. "Yet the argument for all public participation in reclamation [irrigation] is the claim that a great public benefit arises from the reclamation of arid lands. If such is the case, the question arises whether the water users should be expected to repay the whole cost" (Teele 1926:439). In a similar vein a quarter of a century later, the US President's Water Resources Policy Commission argued that it would be improper to sell water to farmers at full cost. "But irrigation development in this country has followed a quite different course [than selling water on a commercial basis]. We have been concerned with developing the arid and semiarid West, with increasing agricultural production, with establishing independent, family-sized farms, with creating opportunities, with broadening the scope of individual property ownership" (US Water Resources Policy Commission 1950:76).

As a result of these types of arguments, irrigation projects which clearly could not be paid for by the water users were built. A number of observers have criticized such policies, arguing that the subsidy has benefited a relatively few individuals (Teele 1927a, LeVeen and Goldman 1978, Seckler and Young 1978). Furthermore, an *ex-post* examination of investments has led to the judgement that most of the projects constructed since 1960 could not be justified in economic terms (Young 1978,

Beale 1978). The general regional development arguments for irrigation projects provided a means for justifying "uneconomic" projects which probably would not have been constructed if the users had been required to pay the full costs.

Income Distribution Objectives

The literature on experience with irrigation financing provides little evidence that irrigation investments contribute to public savings. Financing methods may reduce the outflow of public funds associated with the provision of irrigation services, but it is hard to find examples of a net inflow. The effective rates of subsidy from the central government may be much greater than the nominal rates. For example, in the USA, the nominal subsidy on irrigation projects is zero, with full construction costs to be repaid by the water users, at no interest, plus all O&M costs. But the effective subsidy has been calculated to average 81 percent of the present value of the total costs of irrigation (including both construction and O&M costs) (US Congress, Congressional Budget Office 1983:chapter 2). A recent study on the Central Valley Project in California estimated the effective subsidy in that project to be 91 percent of its total cost (LeVeen and King 1985:table 9). Similar calculations for other countries are not available, but it is clear that low-interest, long-term loans for substantial portions of the capital costs of irrigation lead to very large effective subsidies.

The effect which financing policies have on income distribution among groups within the private sector has received some attention in the literature. Over the years, the income distribution consequences of the federal government subsidy to irrigation in the USA has been criticized (LeVeen and Goldman 1978, Seckler and Young 1978, Teele 1927a). "The public has spent over US$1 billion to create, at most, 300-350 farms. Not only have the windfall benefits accrued to a very few individuals, but also the subsidy will have been used to create economic opportunities for a very few new farmers. . . . In conclusion, the linking of water resource development with rural development has not led to a wide distribution of project benefits to new farmers" (LeVeen and Goldman 1978:932-933).

Because the anticipated benefits of irrigation may be capitalized into land values even prior to the completion of irrigation facilities, the distribution of benefits of irrigation within the private sector may be affected by patterns of land speculation. It has been argued that in the development of the western part of the USA, land speculators sold land to farmers at prices which reflected not only the value that would be added by the irrigation works to be constructed by the government, but also the value of the expected development work on the farm itself. The farmer who purchased land at such prices soon found himself in an impossible financial position (Huffman 1953:chapter 5). Under these conditions, it was the land speculator who was able to capture much of the subsidy provided by the federal government.

More recent studies have also shown that the effect of the government subsidy in the USA is reflected in land prices. Using data from California, and the estimates of the Department of the Interior on the amount of the subsidy associated with irrigation water, Seckler and Young (1978) conclude that the subsidy accounts for almost all of the gross annual revenue of the landowners. Thus, if the owners

were to be charged for water at full cost, nearly all of the rental value of the land would be required to make this payment. Such a situation implies that those who owned the land at the time that its value rose due to the government investment benefited from the subsidy. People who purchased land subsequent to the rise in price did not receive any significant subsidy. Furthermore, to introduce a charge now for the full cost of water would create a severe financial hardship on such people, as it would effectively require them to pay twice for the value of the irrigation water.

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Financing Irrigation Services in Indonesia

Leslie E. Small and Marietta S. Adriano

FINANCING IRRIGATION SERIVICES IN INDONESIA

INTRODUCTION

Indonesia has a tropical monsoon climate with fairly distinct wet and dry seasons. Average annual rainfall is about 1,900 millimeters (mm). Supplementary irrigation in the wet season, however, can result in substantial increases in average yields because of the rather erratic nature of rainfall. Irrigation can also make possible an assured crop (and in some areas two crops) during the dry season. About 96 percent of the total irrigated area of Indonesia is devoted to rice. A second rice crop is grown on about 40 percent of the irrigated area in the dry season (Sarma et al. 1984:4). The total irrigated area is about six million hectares (ha), including about one million in communal-type village (*desa*) systems, and another one million in simple (*sederhana*) irrigation systems (Table 2.1).

Table 2.1. Irrigated area by location and type of system, 1978 (million ha).

Region	Gravity irrigation					Total	Percentage
	Technical	Semi technical	Simple	Village	Tidal and swamp lands		
Java	1.73	0.42	0.53	0.31	-	2.99	50
Bali	-	0.06	0.01	0.04	-	0.11	02
Sumatra	0.23	0.25	0.26	0.32	0.43	1.49	25
Kalimantan	0.01	0.02	0.06	0.16	0.28	0.53	09
Sulawesi	0.06	0.18	0.09	0.11	-	0.44	07
Others	0.07	0.21	0.01	0.10	-	0.39	07
Total	2.10	1.14	0.96	1.04	0.71	5.95	100

Source: Directorate of Irrigation I, Directorate General of Water Resources Development (DGWRD) (1982).

Most irrigation in Indonesia is based on run-of-the-river diversion systems. Water supply in these systems fluctuates during the year, being greatest during the wet season, and least during the dry

season. In many cases, a large irrigated area is supplied by a number of small systems which, because they draw water from the same river, are highly interdependent. Some large systems have storage reservoirs, the largest being Jatiluhur in West Java, with a command area of 304,000 ha.

Gravity irrigation systems, subject to some government support, are frequently classified by the government into three categories: technical irrigation systems, semitechnical irrigation systems, and simple irrigation systems.

Technical irrigation systems are those which have a water supply separate from the drainage system, and where the discharge of water can be measured and controlled at several points. All the structures in these systems are permanent. Water control, through gates, is supposed to be possible down to the tertiary level.

Semitechnical systems have fewer permanent structures and one measuring device (usually at the main headworks). Supply and drainage systems are not always fully separate.

Simple irrigation systems have usually received some government support for construction or improvement, but are often operated and managed by village leaders. These systems have temporary or semipermanent structures and have no water measurement or control devices.

In addition to these three categories of systems, there are communal-type village irrigation systems which do not generally receive support from the central government.

The distribution of these four categories of gravity irrigation systems in the different regions of Indonesia is shown in Table 2.1. Java has half of the total area irrigated; and 82 percent of the area irrigated by technical irrigation systems. The 4 islands of Java, Sumatra, Kalimantan, and Sulawesi account for over 90 percent of the total area irrigated.

The use of groundwater by government irrigation systems is still very limited. Of the estimated potential area of 164,500 ha for groundwater irrigation, systems developed by the government covered only 13,675 ha as of 1984. In addition, there is a considerable amount of private development of groundwater irrigation. It has been estimated that in the province of Central Java, up to 8,000 ha are irrigated by privately financed pumps drawing from very shallow aquifers (Electroconsult Engineering 1985).

The institutional framework in which irrigation development and operation take place in Indonesia is complex. Planning for the development of government irrigation systems is the responsibility of the Directorate General of Water Resources Development (DGWRD) of the Department of Public Works. Legal responsibility for irrigation development and operation to the tertiary outlet is officially decentralized to the provincial governments. The provincial public works departments are the implementing agencies for the provincial governments, receiving technical guidance from DGWRD. Much of the funding for irrigation activities, however, comes from the central government, either through the Provincial Governor's Office, or directly from DGWRD to the provincial public works departments, which are thus responsible for operating separate budgets

from the central and provincial governments. Furthermore, some of the larger projects, particularly those receiving external funding, are directed from the central government during the construction phase. In the case of at least one large project (Jatiluhur), a separate executive body, with its own project field offices, is responsible for project operation.

Below the tertiary level, operation and maintenance (O&M) of irrigation projects are generally considered to be the responsibility of the water users at the village level. Given differences in the size of projects, these "tertiary" units vary greatly in size. In small projects, government responsibility may extend to areas much smaller than the size of the tertiary units that are being managed by water users in other projects. Villages are also responsible for the construction and operation of the communal irrigation systems. A variety of types of water users' associations may exist to assist in the implementation of these responsibilities.

IRRIGATION FINANCING POLICIES AND PROCEDURES

General Policies

In legal terms, responsibility for irrigation O&M in Indonesia is decentralized. Responsibility for the operation of irrigation systems was assigned to the provinces in 1953 by Government Regulation No. 18, despite the limited funds available to the provincial governments for this work. During the 1950s and early 1960s, little investment was made in irrigation systems. Maintenance of systems was frequently very poor, and many of them deteriorated badly. In the late 1960s, rehabilitation efforts were undertaken by the central government with financial assistance from external donors. In more recent years, major investments in new irrigation have taken place, again frequently with external financial assistance.

Investment in irrigation has been seen by the government as a general development expenditure necessary to support the self-sufficiency objectives of Indonesia's development plans. Its policy for financing the capital cost of rehabilitation and new investments has been to rely on general government revenues to provide the necessary funds both for the local component of the initial financing, and for the subsequent repayment of foreign loans incurred. There has been little concern with recovering the capital cost of irrigation development from the water users.

With respect to policy for the financing of O&M, a distinction must be made between the main distribution system (primary and secondary canals) and the tertiary system (the portion of the system below the outlets to the tertiary canals). Physical and financial responsibility for O&M of the tertiary system belongs to the villages and their farmers. Responsibility for the O&M of the main system — even in very small public irrigation projects — resides formally with the provincial governments. The inadequate level of financial resources available to them, however, has led to increased central government funding of these O&M activities. The complex financial arrangements by which this is accomplished are discussed in the next section.

Historically, farmers have not been charged directly for the cost of the O&M services provided by the provincial or central governments. Prior to independence (from Dutch rule), a land tax (*landrente*)

was levied on all agricultural lands. Because irrigated land was taxed at higher rates than rain-fed land, this tax had the effect of indirectly recovering a portion of the costs of the irrigation services; there was no attempt, however, to identify the incremental funds generated from this tax as a result of irrigation, or to earmark any portion of it for financing O&M costs.

After independence, the land tax was abolished, but ultimately a land-based tax, first known as the Tax on Land Production (*Pajak Hasil Bumi*) and subsequently renamed Contribution to Regional Development (*Iuran Pembangunan Daerah* or *IPEDA*) was re-established (Kim 1981, Gadjah Mada University 1982:26-27). This tax primarily funds rural development activities of district governments. Although it represents, as did the landrente, an indirect mechanism of recovery of irrigation costs, it is not a tax to fund irrigation O&M, and there is no financial linkage between the revenues generated from the tax and the funds provided for O&M.

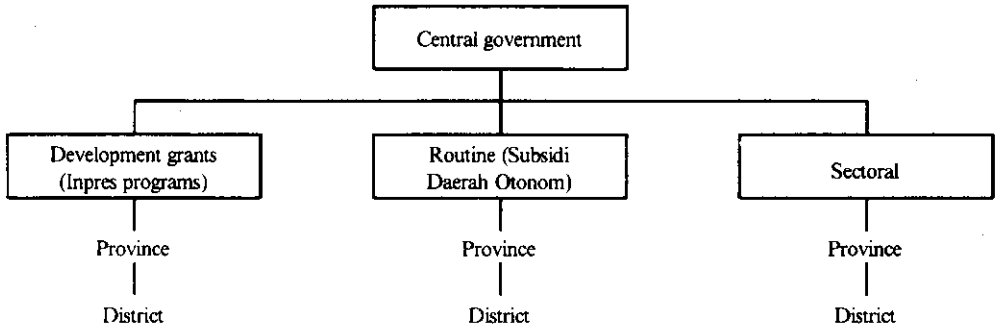
In 1985, a law creating a Land and Building Tax (PBB) was passed. This new tax, which was supposed to come into operation on 1 January 1986, will replace IPEDA; during a transition period to last to the end of 1990, however, some of the features of IPEDA will remain (Indonesia 1986).

Budgetary Procedures

Flow of funds for irrigation development. Complex financial relationships exist between the central government and the provincial governments, which receive about 75 percent of their revenues from central government sources. The flow of funds from the central government is illustrated in Figure 2.1. Four main budgets or funds are involved. The *Subsidi Daerah Otonom* is a routine budget for the salaries and allowances of permanent civil servants employed by the regional governments (provinces and below) but paid by the Ministry of Home Affairs. It represents about 46 percent of the total revenues of the regional governments and 22 percent of the national routine budget. The *Bantuan Pembangunan Dati I (Inpres Dati I)* or Provincial Development Grant is a multipurpose grant for development projects in the provinces. It has both fixed (earmarked) and discretionary components. Its funds may be used for upgrading and rehabilitating irrigation systems, for roads and bridges, and for irrigation O&M. Salaries cannot be paid from these funds. Allocation of this fund among provinces is based on population, the size of area cultivated, and the length of existing roads. The *Bantuan Kabupaten Dati II (Inpres Dati II)* is a fund for the district (*kabupaten*) government. Although it is not specifically earmarked, most of it is spent on infrastructure development, with about 10–15 percent spent on infrastructure maintenance. The allocation is based in part on population, and in part on the assessment by Indonesia's National Development Planning Agency (BAPENNAS) of the relative ability of the districts to implement programs. The fourth budget is the *sectoral budget* (APBN) of the DGWRD, which is provided directly to the provincial public works departments. These departments submit project proposals to the provincial authorities, who appraise and recommend the proposed projects to the central government.

In addition to the funds received from the central government, the provincial and district governments obtain revenues from directly levied taxes and charges. Some revenues levied by the central government may also be retained wholly or in part by the provincial and district governments.

Figure 2.1. Funding flows from the central government to province and district levels.



Using data for 1980-1981, Bottrall (1981) developed budget estimates categorized by source of responsibility for expenditures (Table 2.2). The sectoral budget of the DGWRD provided Rp 200.3 billion,[1] which was 74 percent of the total government funds for irrigation development and O&M. When funds from foreign aid are included, funds for which DGWRD was responsible amounted to Rp 267.2 billion, or 80 percent of the total. About 54 percent of the DGWRD funds were for new construction, 37 percent for rehabilitation, and the remainder for swamp and tidal development. An additional Rp 13.9 billion for tertiary development and rehabilitation was also provided by a manpower (*Radat Karya*) program of the central government.

At the provincial government level, the provincial public works departments were responsible for a total budget of Rp 39.3 billion. Most of these funds also came from central government sources. Rp 7.4 billion for rehabilitation and improvement work and Rp 19.8 billion for O&M were funded from specifically earmarked Inpres Dati I funds. In addition, Bottrall (1981) estimated that about Rp 2.2 billion of the discretionary Inpres Dati I budget allocated to the provincial governments was used for irrigation purposes. Salaries for regular irrigation staff of the provincial public works departments, paid from the routine budget (Subsidi Daerah Otonom), were estimated at Rp 8.2 billion. Direct contributions from provincial revenues are thus very small.

At the district and village levels, the Inpres Dati II (Rp 7.8 billion) and the *Inpres Desa* (Rp 4.9 billion) are the principal sources of funds. These funds are used for small construction and repair work. The contribution from direct revenues, estimated at Rp 0.8 billion, is largely from the land-based tax, IPEDA. Although IPEDA revenues are enhanced by irrigation, their direct use for irrigation financing is very limited.

It can be determined from Table 2.2 that of the total government expenditures on irrigation development and O&M, the central government had direct responsibility for expenditure of 84 percent, the provincial governments for 12 percent, district governments for about 2.5 percent, and village governments for about 1.5 percent. Some of the funds for which the regional governments

[1]US$1 =Rp 415 in 1976, 644 in 1981, and 1,074 in 1984.

have expenditure control, however, are provided from the central government, and represent specific budgetary decisions made at the central level. For example, the allocations for rehabilitation and improvement and O&M of irrigation systems are provided by the central government as part of the Local Government Development Program, with the amounts to be expended on irrigation improvement and O&M specified. Likewise, the routine budget for salaries is also provided by the central government through the Subsidi Daerah Otonom.

Table 2.2. Government financing of irrigation development and O&M, by source of responsibility for expenditures 1980-1981 (billion Rp).

Source of responsibility	Purpose	Government expenditure	Foreign aid	Total
Central government				
Public works	New construction	110.5	34.3	144.8
Public works	Rehabilitation	69.0	29.6	98.6
Public works	Swamp and tidal	20.8	3.0	23.8
Subtotal, public works		200.3	66.9	267.2
Agriculture	Tertiary organization	0.3	-	0.3
Manpower (Radat Karya)	Tertiary construction and rehabilitation	13.9[a]	-	13.9[a]
Manpower	General program	1.8[a]	-	1.8[a]
Subtotal, central government		216.3	66.9	283.2
Provincial government				
Public works	Rehabilitation/improvement	7.4	-	7.4
Public works	O&M	19.8	-	19.8
Public works	Inpres Dati I	2.2[a]	-	2.2[a]
Public works	Local taxes *(Asli daerah)*	1.2[a]	-	1.2[a]
Public works	Routine budget	8.2[a]	-	8.2[a]
Agriculture	Miscellaneous	0.5[a]	-	0.5[a]
Subtotal, provincial government		39.3	-	39.3
District				
	Inpres Dati II	7.8	-	7.8
	Local taxes	0.8[a]	-	0.8[a]
Village				
	Inpres desa	4.9[a]	-	4.9[a]
Total		269.1	66.9	336.0

[a]Estimated.
Source: Bottrall (1981).

A breakdown by actual source of budget decisions for 1980-1981 is given in Table 2.3. Decisions regarding the types of expenditures are made by the central government for approximately 95 percent of the total expenditures. The provincial governments have discretionary decisions over only about 1.2 percent of the total expenditures. District governments have control over decisions involving about 2.6 percent of the funds, and villages control decisions for about 1.4 percent of the funds. Thus, the provincial government has the smallest amount of funds over which it is authorized discretionary control regarding the type of use to which the funds are put.

Next >>

Table 2.3. Government financing of irrigation development and O&M, by source of budget decisions, 1980-1981 (billion Rp).

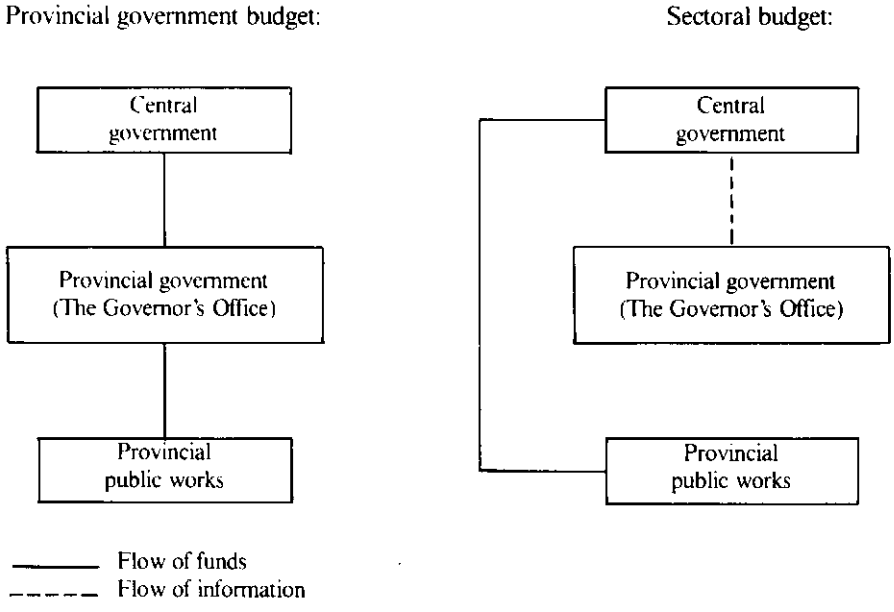
Central government		
New construction	144.8	
Rehabilitation and improvement	106.0	
Tertiary construction and rehabilitation	13.9	
Swamp and tidal development	23.8	
O&M	19.8	
Routine budget (salaries)	8.2	
Miscellaneous	2.1	
Total	318.6	(94.8%)
Provincial government		
Inpres Dati I (discretionary portion)	2.2	
Local taxes	1.2	
Miscellaneous	0.5	
Total	3.9	(1.2%)
District government		
Inpres Dati II	7.8	
Local taxes	0.8	
Total	8.6	(2.6%)
Village government		
Inpres desa	4.9	(1.4%)
Total	336.0	(100.0%)

Source: Derived from Table 2.2.

Even these figures understate the share of funds which actually originate with the central government. The amounts for the various Inpres programs mostly originate from central government funds. Overall, approximately 99 percent of the funds for irrigation development and operation originate with the central government.

Allocations for main system O&M. Since 1974, as a result of Presidential Instruction No. 7 of that year, the central government has provided earmarked funds (through Inpres Dati I) to the provincial governments for the O&M of irrigation systems. These funds are provided through the provincial government budget (APBD). Beginning in 1984/85, additional funding was provided for certain rehabilitated project areas considered to be vital to whole irrigation systems. These funds come from the sectoral budget, and flow directly to the provincial public works departments. The funds from the sectoral budget are designed to supplement the Inpres Dati I funds. By by-passing the Provincial Governor's Office, the sectoral budgetary funds are expected to be more readily available to the provincial public works departments. Schematic representations of the allocation of the funds from the sectoral budget and the provincial government budget are presented in Figure 2.2.

Figure 2.2. Central government subsidies for O&M of irrigation systems.



Source: DGWRD (1984).

O&M allocations from the central government for irrigation systems under the Department of Public Works are shown in Table 2.4 for the years 1974/75-1985/86. All the allocations, except those indicated for 1984/85 and 1985/86, are through the Inpres Dati I. There have been significant increases in the allocations to the provincial governments for O&M expenditures. In 1974/75, the first year of the Inpres Dati I, the total budget was Rp 5.9 billion (equivalent to approximately Rp 24.1 billion in terms of 1984 prices). By 1983/84 the allocation had risen to Rp 32.9 billion. An additional Rp 11.3 billion was made available beginning in 1984/85 through the sectoral budget.

Considering the first 3 years of the allocation of provincial government budgetary funds (1974/75-1976/77) and the last 3 years prior to the provision of the additional funds through the sectoral budget, the average annual allocation per hectare of eligible area increased in terms of constant 1984 prices from about Rp 6,180 to about Rp 8,100, or 31 percent. The more recent supplementary allocations to special areas, with sectoral budgetary funds coming directly from the DGWRD, have earmarked about Rp 11,000/ha for these special areas. These substantial increases in the O&M budget, when coupled with the very limited amount of funding for O&M from direct provincial and district sources, have further increased the dependence of the provincial governments on the central government for irrigation O&M.

The original intent of the Presidential Instruction in 1974 was to decrease gradually the total funding for O&M provided by the central government, which was regarded as a subsidy to the provincial

Table 2.4. Central government allocations of funds for O&M of irrigation systems operated by provincial departments of public works, 1974-1985.

Year	Eligible area ('000 ha)	Proposed budget		Approved budget		
		Total (billion Rp)	Per ha (Rp)	Total (billion Rp)	Per ha	
					Current Rp	1984 Rp[a]
1974/75	3657	5.9	1600	5.9	1600	6638
1975/76	3724	11.0	2844	5.7	1540	5680
1976/77	3249	9.0	2671	6.3	1931	6224
1977/78	3772	14.8	3719	7.9	2100	5988
1978/79	4347	15.1	3493	10.0	2293	5893
1979/80	4475	21.9	4888	13.0	2965	5750
1980/81	4541	23.0	5065	19.8	4354	6539
1981/82	4578	36.2[b]	7911	26.0	5682	7747
1982/83	4507	47.8[c]	10598	31.2	6920	8741
1983/84	4669	59.5[d]	12749	32.9	7093	7817
1984/85						
Provincial government budget	3907	-	-	30.7	7866	7866
Sectoral budget[e]	986	-	-	11.3	11512	11512
1985/86						
Provincial government budget	3949	-	-	32.4	8210	-
Sectoral budget[e]	1009	-	-	11.9	11801	-

[a]Current Rupiahs adjusted by the Implicit GDP Deflator (Asian Development Bank 1985).

[b]Three earlier alternatives — high, medium, and low — had been presented to the National Development Planning Division and rejected. These were:
High Rp 43.7 billion; 9,603 Rp/ha.
Medium Rp 40.3 billion; 8,858 Rp/ha.
Low Rp 38.2 billion; 7,951 Rp/ha.
The large increase in proposed O&M expenditure in 1981/82 reflects an attempt by Directorate of Irrigation II to persuade the Government of Indonesia to increase the O&M subsidy.

[c]This is the "low" alternative presented to the National Development Planning Division. The high alternative was Rp 50.5 billion.

[d]This is the "low" alternative presented to the National Development Planning Division. The high alternative was Rp 63.6 billion.

[e]Starting 1984/85, additional funds for O&M were made available from the sectoral budget of the DGWRD.
Source: Directorate of Irrigation II (1985).

governments. It was expected that over time, the provincial governments would develop their capabilities for self-financing. This expectation has not been realized. Table 2.5 presents the total central government funding for the Local Government Development Program from 1974/75-1983/84, expressed in 1984 prices. The total amount has increased 53 percent from Rp 182,333 million in 1974/75 to Rp 278,825 million in 1983/84. The proportion of these funds earmarked for irrigation O&M has ranged between 10-13 percent throughout the period. In Java, however, the average proportion of the total funds from the central government devoted to O&M is much higher than the national average, ranging from 26 percent in Central and East Java to 37 percent in West Java.

Table 2.5. Central government funding for the Local Government Development Program, 1974/75-1983/84 (million 1984 Rp[a]).

Fiscal year	Funding for fixed programs				Funding for discretionary program	Total	Percentages		
	Rehabilitation for roads and bridges	Rehabilitation for irrigation systems	O&M for irrigation, swamp, & river	Total					
(1)	(2)	(3)	(4)	(5)=(2+3+4)	(6)	(7)=(5+6)	(3)/(7)	(4)/(7)	(5)/(7)
1974/75	11409	14997	24276	50682	131651	182333	8.2	13.3	27.8
1975/76	12554	19473	21154	53181	139653	192834	10.1	11.0	27.6
1976/77	12959	18038	20221	51218	143618	194836	9.3	10.4	26.3
1977/78	16240	16877	22586	55703	158167	213870	7.9	10.6	26.0
1978/79	17960	17401	25613	60974	159192	220166	7.9	11.6	27.7
1979/80	16128	12047	25730	53905	144343	198248	6.1	13.0	27.2
1980/81	34167	11123	29693	74983	175209	250192	4.4	11.9	30.0
1981/82	40816	13759	35462	90037	203106	293143	4.7	12.1	30.7
1982/83	43856	14803	39454	98113	221459	319570	4.6	12.3	30.7
1983/84	38661	10153	36253	85067	193758	278825	3.6	13.0	30.5

[a]Current figures converted to 1984 Rupiahs using the Implicit GDP Deflator (Asian Development Bank 1985).
Source: DGWRD (1984).

While the average proportion of the central government funds for the Local Government Development Program for irrigation O&M has remained within the narrow range of 10-13 percent, the proportion of the funds used for rehabilitation of irrigation systems has decreased every year, from 10 percent in 1975/76 to only 3.6 percent in 1983/84.

Budget requests for main system O&M are prepared by the provincial public works departments, using guidelines prepared by DGWRD. These calculations include O&M costs for the different types of irrigation systems (i.e., technical, semitechnical, and simple) and overhead expenditures for the provincial- and section-level offices. In each province, the resulting budget proposal is submitted to the Regional Development Planning Body of the province (BAPEDDA) for evaluation. Subsequently, a national team consisting of representatives of the National Development Planning Agency, the Ministry of Internal Affairs, the Ministry of Public Works, and the Ministry of Finance visits the province to discuss the budget request with the Regional Development Planning Body, and to reach a decision on the amount of Inpres Dati I funds to be provided. The provincial public works departments in turn decide on the allocations to their various section offices.

As shown in Table 2.4, the approved budgets for O&M have averaged less than 60 percent of the amounts requested. For example, the "low" budget proposal for irrigation O&M for 1983/84 was Rp 59.5 billion, but the amount approved was only Rp 32.9 billion. This represents 55 percent of the "low" budget request, and only 52 percent of the "high" alternative of Rp 63.6 billion.

CAPITAL COST OF IRRIGATION

Information on the capital cost of irrigation in Indonesia available in the literature is limited. Cost estimates for the Arakundo-Jambu Aye Project are presented in the Appraisal Report for the project (Sarma et al. 1984:22). Excluding the estimated component for price escalation (which refers to price increases subsequent to 1984) and the component for a bridge, the total project costs are estimated to be US$93.9 million. This implies an average cost of about US$4,850/ha for the 19,360 ha area of the project. This is equivalent to Rp 5.2 million/ha.

Bottrall (1981:37) reports on the construction cost of 1 small project (*Sedang Kecil*) being built in 1980/81 with a command area of 340 ha. The cost was expected to be Rp 350 million, or approximately Rp 1.0 million/ha. Based on the Implicit GDP Deflator (Asian Development Bank 1985), this would amount to approximately Rp 1.5 million/ha at 1984 prices.

The expected construction costs of 2 irrigation projects financed by the Asian Development Bank, the Cibaliung and the Lower Citanduy, were US$2,042 and US$2,644/ha, respectively (Kim 1981:15). At 1984 prices, these would amount to approximately Rp 2.2 and Rp 2.8 million/ha.

As rules of thumb, DGWRD indicates that the capital cost for new irrigation projects is roughly Rp 3.0 million/ha for large projects (greater than 10,000 ha), Rp 1.5 million/ha for medium projects (2,000-10,000 ha), and around Rp 0.8 million/ha for small projects. Some data on the investment cost of groundwater pump projects are available. Data from DGWRD indicate that the costs for five different sizes of wells varies from Rp 0.8-2.7 million/ha. This is roughly consistent with the costs, reported for an appraisal of groundwater development in Central Java, of US$800-2,150 (Rp 0.9-3.4 million)/ha (Electroconsult Engineering 1985:23).

OPERATION AND MAINTENANCE COSTS

Expenditures for O&M

Gravity irrigation O&M: main systems. Information on actual expenditures for O&M is quite fragmentary. Discussions in previous sections suggest that O&M expenditures for the main systems are largely limited to the earmarked funds coming from the central government. This suggests the national average current expenditures are Rp 8,000-12,000/ha (Table 2.4). But data on the amount of central government funds for irrigation O&M budgeted for 1983/84 for each province vary widely among the provinces in the average amounts expended per hectare, generally about Rp 5,900-16,500/ha 3,200-43,600 of "potential" irrigation area (Table 2.6). There is a distinct tendency for provinces with little irrigated area to have relatively high per-hectare values, probably reflecting the portion of funds that are needed for the relatively fixed costs of administrative overhead at the regional government levels.

Table 2.6. Central government grants to provincial governments for irrigation O&M, 1983/84.

Province	Potential irrigation area (ha)	O&M grant ('000 Rp)	O&M grant/ha (Rp)
1. D.I.[a] Aceh	154234	950000	6160
2. Sumatera Utara	259855	1800000	6927
3. Sumatera Barat	213729	1500000	7018
4. Rian	84379	800000	9481
5. Jambi	27268	450000	16503
6. Sumatera Selatan	88120	1000000	11348
7. Bengkulu	50085	750000	14975
8. Lampung	133161	1300000	9763
9. DKI Jaya	21676	220000	10150
10. Jawa Barat	888391	5750000	6472
11. Jawa Tengah	756081	4500000	5952
12. D.I.[a] Yogyakarta	65377	860000	13155
13. Jawa Timur	950247	5300000	5578
14. Kalimantan Barat	58053	500000	8613
15. Kalimantan Tengah	80086	500000	6243
16. Kalimantan Selatan	155098	500000	3224
17. Kalimantan Timur	57015	430000	7542
18. Sulawesi Utara	51894	600000	11562
19. Sulawesi Tengah	44892	500000	11138
20. Sulawesi Tenggara	25245	250000	9903
21. Sulawesi Selatan	271670	1650000	6074
22. Bali	59106	800000	13535
23. Nusa Tenggara Barat	135672	1275000	9398
24. Nusa Tenggara Timur	31430	500000	15908
25. Maluku	3342	110000	32914
26. Irian Jaya	450	-	-
27. Timor Timur	2290	100000	43668
Total, Indonesia	4668846	32895000	7046

[a] *Daerah Irigasi* or irrigation district.
Source: DGWRD (1984).

Data on the average allocation of O&M funds for technical and semi-technical systems in Lampung Province between 1980/81 and 1984/85 are presented in Table 2.7. Although the overall average allocation for O&M is Rp 7,039/ha, the average for the 14 technical systems was only Rp 5,346, while for the 40 semitechnical systems the average was Rp 18,423. One possible explanation for this unexpected result is that the O&M cost per hectare for small systems may tend to be greater than for large systems. In the case of Lampung, all 40 of the semitechnical systems were less than 1,000 ha in size, and 29 of them were under 500 ha. By contrast, only 4 of the 14 technical systems were under 1,000 ha.

Table 2.7. O&M fund allocation by scale and type of irrigation system, Province of Lampung, 1980/81-1984/85.

Scale (ha)	Technical			Semitechnical			Total		
	Number of projects	Area (ha)	Average O&M[a]	Number of projects	Area (ha)	Average O&M[a]	Number of projects	Area (ha)	Average O&M[a]
< 500	2	750	21325	29	6659	23876	31	7409	23348
501 - 1000	2	1331	5950	11	6532	12863	3	7863	11544
1001 - 5000	4	8263	4902	0	0	0	4	8263	4902
> 5000	6	76468	5227	0	0	0	6	76468	5227
Total	14	86812	5346	40	13191	18423	44	100003	7039

[a]Average O&M funds allocated during five-year period, 1980/81-1984/85 (Rp/ha/year).
Source: Pasandaran (1985).

Taylor (1979) reports that main system O&M expenditures in the Pekalen Sampean Irrigation Project for 1973/74 amounted to approximately Rp 830/ha, which is approximately equivalent to Rp 5,070 in 1984 prices. He notes that approximately 90 percent of this amount was for salaries of personnel, 5 percent for equipment and 5 percent for materials.

Bottrall (1978) studied one section (Jember) of the same project earlier studied by Taylor. He noted that expenditure levels had risen sharply, reflecting the central government's concern with improving the quality of O&M. The section engineer reported to him that O&M expenditures for 1976/77 were US$8 (Rp 3,320)/ha, which is equivalent to about Rp 10,700 in 1984 prices.

A study, financed by a loan from the World Bank and conducted by a team from Gadjah Mada University (1982), examined the O&M situation in the Gung Irrigation Section of Pemali-Comal, Central Java. Actual O&M expenditures for the main irrigation system were estimated to be about Rp 9,000/ha, of which nearly half was for wages and salaries, and about 35 percent was for direct O&M of channels and hydraulic structures. An additional Rp 1,800 was estimated to have been spent for O&M costs at the regional and provincial levels. Although not clearly specified in the report, this presumably refers to administrative overhead expenditures.

Gravity irrigation O&M: tertiary level. Physical and financial responsibility for the tertiary-level facilities (tertiary and quartenary canals and related structures) are the responsibility of the farmers, through local institutions such as the village (desa) government and various types of water users' associations, such as OPPA, *Perkumpulan Petani Pemakai Air* (P3A), *Dharma Tirta*, and *Subak*. These associations usually require that farmers pay a fee per hectare per season either in cash or in-kind. In addition, farmers may also contribute materials for construction and labor as the need arises.

The large number of water users' associations and the differences among them make it difficult to obtain aggregate data that would facilitate generalizations regarding the nature and magnitude of

tertiary O&M expenditures. In 10 sample high-performance sederhana irrigation projects, farmers paid an average of 36 kilograms (kg) of unmilled rice/ha per season, but the amounts ranged from 12 kg in one project to 75 kg in another.

Even where there are no formal water users' associations, farmers often organize themselves, at the tertiary level, for voluntary labor for the purpose of cleaning and maintaining farm-level canals and ditches. Farmers make contributions in terms of cash, labor, or in-kind to the *ulu-ulu*, the person responsible for irrigation matters in the village. Examples of the magnitude of such payments are shown in Table 2.8. Using a rice (unmilled) price of Rp 100/kg, the value of these contributions generally ranges from Rp 4,000-25,000/ha per year.

Table 2.8. Examples of farmers' payments to village irrigation officials.[a]

Type of system and location	Average rate/ha/crop (kg unmilled rice[b]/ha)	Cropping pattern	Value of total annual payments
Run-of-the-river projects			
1. Bali:			
a. DPU[d] system	20	Rice-rice	4000
b. Communal system	10	Rice-rice	2000[c]
2. Pekalen Sampean, East Java DPU system or	30-50	Rice-rice rice-upland	6000-10000
3. Sragen/Solo Region, Central Java — Dharma Tirta communal system	115	Rice-rice-rice	34500
4. Lake Toba Region, North Sumatra — communal system	20	Rice-rice	4000
Sidrap, South Sulawesi, DPU system	50	Rice-rice	10000
Pump projects			
1. Kediri-Nganjuk, East Java, DPU tube wells	e	Rice-rice or rice-upland	25000-40000
2. Sedrap, South Sulawesi, communal low-lift pumps	100	Rice-rice	20000

[a]Labor contributions for O&M are excluded from this table.

[b]Unmilled rice is valued at Rp 100/kg.

[c]Plus special contributions for major maintenance and repair when the need arises, may be up to Rp 6,000/ha, but not every year.

[d]Department of Public Works.

[e]Payments for fuel consumption and for the pump operator are based on an hourly charge of Rp 250-600.
Source: Bottrall (1981).

Taylor (1979) found that in the Pekalen Sampean Project, payments by farmers to local village officials for irrigation services (including the imputed value of unpaid labor) averaged about Rp 3,780/ha, equivalent to about Rp 23,100 at 1984 prices. In his subsequent study of one portion of the same project, Bottrall (1978:14) reported generally similar rates of payment.

In their study of 2 project areas, the Gadjah Mada University team reported that the average cash contribution of the farmers for tertiary O&M was about Rp 2,500 in the Pemali-Comal area of Central Java, and about Rp 2,400/ha in the South Sulawesi area (Gadjah Mada University 1982:25). Additionally, farmers contributed an unspecified amount in the form of unpaid labor.

Data on farmer contributions to O&M for 1983/84 in three small irrigation projects — one technical, one sederhana, and one communal — are presented in Table 2.9. The amounts range from about Rp 5,000-11,000/ha per season, with the total annual contributions ranging from Rp 11,400-21,100/ha. The largest figure is for the communal system, which is entirely managed by the local water users' association. The relatively high farmer contribution to the technical system (Rp 17,100/ha per year) reflects the fact that this system supports 3 crops/year. The lowest level of contribution was for the sederhana project. This was attributed to the uncertainty which the farmers in the project face regarding the ownership status of this system.

Table 2.9. Farmers' contributions to O&M in selected irrigation systems, Sukabumi, 1983/84.

Irrigation system	Type of system	Area (ha)	Value of farmers' contribution (Rp/ha)			
			First crop	Second crop	Third crop	Annual total
Ciraden	Public works-technical	456	6900	5300	4900	17100
Cisungapan	Public works-sederhana	126	5800	5600	0	11400
Cigayung	Communal	107	10500	10600	0	21100

Source: Pasandaran (1985).

Data on O&M expenditures by farmers in irrigation systems in Cirebon District of West Java in 1980/81 distinguish contributions made in-kind to the village officials, labor contributions for O&M, and cash contributions for maintenance and repair (Table 2.10). Information was collected for each of the three cropping seasons during the year. For areas where rice dominated the cropping pattern throughout the year, the contributions amounted to Rp 33,150/ha, or about Rp 49,700/ha in 1984 prices. In areas predominantly planted to crops other than rice during the dry season, the total payment was Rp 21,450/ha (Rp 32,200 in 1984 prices).

From the information presented in this section, it is clear both that the farmers' contributions for O&M at the tertiary level can be quite substantial — in some cases considerably exceeding the per hectare expenditures of the government for main system O&M — and that the amount of their contributions can vary widely among systems.

Table 2.10. Irrigation O&M expenditures of the farmers in selected areas of the Cirebon Irrigation System, 1980/81 (Rp/ha).

Type of irrigated area and season	Value of contribution to village officials	Value of labor contribution for O&M	Cash contribution for maintenance and repairs	Total
Predominantly planted to rice throughout the year				
First dry-season crop 1980	9200	750	2000	11950
Second dry-season crop 1980	2400	2250	7500	12150
Rainy-season crop 1980/81	3800	750	4500	9050
Total	15400	3750	14000	33150
Diversified crops during dry season				
First dry-season crop 1980	3200	750	1500	5450
Second dry-season crop 1980	1600	2250	4200	8050
Rainy-season crop 1980/81	3200	750	4000	7950
Total	8000	3750	9700	21450

Source: Pasandaran (1985).

Pump irrigation O&M. Government groundwater irrigation projects are relatively new, with the existing systems being in operation for 10 years or less. The projects are developed by DGWRD in the expectation that subsequent to their construction, farmers will assume responsibility for their O&M. This has proved to be problematic, partly because of the high cash requirements for O&M costs, especially in areas where surface irrigation water is available at a much lower cost to the farmers. The cost of operation, including regular maintenance but excluding major repairs, has been estimated by the Groundwater Development Project Office of the DGWRD to average about Rp 1,320/hour of pumping.

Based on this estimate, the O&M costs per hectare for different crops were estimated. For wet-season rice, where pump irrigation is used only to supplement rainfall during periods of critical need, the cost of pumping is calculated to be Rp 9,762/ha. For rice grown during the dry season, however, the cost is estimated to be Rp 81,860/ha. Corn or peanuts planted after the first wet-season crop has estimated pumping costs of Rp 30,214/ha, while a third crop of corn would entail pumping costs of Rp 42,225/ha. These various pumping costs are indicative figures as the actual number of pumping hours also depends on factors such as the type of soil and the amount of water received from rainfall.

A water users' association (OPPA) in Bantul, Pajangan, in the Province of Yogyakarta, charges a fee for groundwater irrigation of Rp 150,000/ha per crop, payable in 3 installments: during land preparation, after planting, and before harvest. Of this amount, approximately Rp 80,000/ha — only 53 percent — is for fuel and spare parts. By contrast, approximately 90 percent of the cost estimate of DGWRD is for these items. For the Association the remaining 47 percent of the fee consists of

Rp 20,000 for canal maintenance; Rp 20,000 for honoraria for the association officers and wages for the pump operator; and Rp 30,000 for administration of the association, meetings, and training programs. Of the 60 ha covered by the Association, only 10 ha of rice were being irrigated during the dry-season crop of 1985 because of the high cost of pumping and the depressed price of rice.

Desired Expenditures for O&M

The Subdirectorate of Operation and Maintenance under the Directorate of Irrigation I of DGWRD has calculated detailed estimates of the expenditures needed for O&M for the different types of gravity irrigation systems. The estimated total costs, calculated at 1983 prices, are, Rp 13,600/ha for technical irrigation systems, Rp 9,718/ha for semitechnical irrigation systems, and Rp 5,388/ha for simple irrigation systems.

The cost components underlying these figures are presented in Table 2.11. Based on these standards, the proportion of total O&M costs used for salaries and wages would be 25 percent in the case of simple and semitechnical irrigation systems, and 28 percent in the case of technical irrigation systems. This is a much lower proportion than reported in the studies by Taylor (1979) and Gadjah Mada University (1982) noted in the previous section. The DGWRD guidelines show a correspondingly larger proportion of the total funds used for the actual maintenance of irrigation canals and structures.

Table 2.11. Main system O&M standard costs by type of irrigation system[a] ('000 Rp).

Item	Type of system		
	Technical	Semitechnical	Simple
Salaries/wages of personnel	115200	72720	39840
Maintenance of facilities[b]	12880	8520	6360
Maintenance of irrigation canals and structures	250800	184800	95700
Upgrading of services (tertiary)	7500	7500	7500
Other	22260	18000	12240
Total	408640	291540	161640
Average cost/ha per year (Rp)	13600	9718	5388

[a]Based on a system size of 30,000 ha.

[b]Includes motor cycles, bicycles, offices, and staff houses.

Source: DGWRD (1983).

In addition to these "standard" O&M costs per hectare, DGWRD has estimated the normal O&M cost (exclusive of emergency repairs due to natural disasters) of four types of special structures: reservoirs, pumps, flood control dikes, and small weirs. The estimated annual O&M costs, also calculated in

terms of 1983 prices, are, for reservoirs, Rp 200,000/million cubic meters of storage; for pumps, Rp 105,000/pump; for flood control dikes, Rp 600,000/kilometers (km); and for small weirs, Rp 100,000/km.

The Gadjah Mada University study of O&M in the Gung Irrigation Section of the Pemali-Comal Project concluded that the existing allocation for O&M was not sufficient for efficient operation. The team estimated that an "adequate" average allowance for the total O&M cost of the main system and tertiary level would be Rp 21,100/ha per year. This estimate, made for the 1980/81 year, is equivalent to about Rp 31,650 in 1984 prices. About Rp 13,000 of this amount (Rp 19,500 in 1984 prices) would be to provide for the main system O&M costs and the remaining Rp 8,000 (Rp 12,000 in 1984 prices) would be for the O&M costs at the provincial and tertiary irrigation levels. The proposed amount for the main systems is somewhat greater than the DGWRD calculations for technical irrigation systems. A comparison of the actual and proposed O&M costs for the Gung Irrigation Section is shown in Table 2.12.

Table 2.12. Comparison of actual and proposed O&M costs, Gung Irrigation Section (Pemali-Comal, Central Java).

Item	Actual		Proposed	
	(Rp/ha)	% of total	(Rp/ha)	% of total
Main irrigation system, total	(9074)	(67.8)	(12634)	(59.9)
Wages and salaries	4442	33.2	5027	23.8
Transport and vehicle maintenance	149	1.1	395	1.9
Office supplies	276	2.1	221	1.1
O&M costs (routine+ periodic)	-	-	393	1.9
O&M (channels, hydraulic structures, inspection)	3170	23.7	5748	27.2
Miscellaneous	1037	7.7	850	4.0
O&M cost at regional and provincial levels[a]	1815	13.6	2520	11.9
Tertiary irrigation level, total	(2490)	18.6	(5950)[b]	(28.2)
Channel maintenance cost	-	-	3750	17.7
Hydraulic structure maintenance cost	-	-	500	2.4
Complementary structure maintenance cost	-	-	500	2.4
Ulu-ulu and P3A salaries	-	-	1200	5.7
Total	13379	100.0	21104	100.0

[a]Estimated to be 20 percent of the main system O&M cost.

[b]This figure includes the actual outlays (in cash and in-kind) by the farmers amounting to Rp 2,490, and the imputed value of the farmers' labor contribution (Rp 3,460).

Source: Gadjah Mada University (1982).

As shown in Table 2.12, the increase in O&M expenditures proposed in the Gadjah Mada University study would also change the relative allocation to various categories of expenditures. Data on the actual expenditures on O&M for the main irrigation system studied by Gadjah Mada University indicate that nearly 50 percent of the total expenditures was for salaries and wages. Expenditures on O&M of channels, hydraulic structures, and inspection accounted for about 35 percent of the government's expenditures. The proposed O&M cost for the main system has a relatively lower proportion (about 40 percent of the amount spent on the main system, or 24 percent of total main system plus tertiary system O&M) allocated for wages and salaries, while a larger percentage (nearly half of the main system O&M expenditures) would be allocated for O&M of channels, hydraulic structures, and inspection, including routine and periodic O&M costs.

At the tertiary level, the Gadjah Mada University study estimated the farmers' contribution in cash and in-kind to be Rp 2,490/ha per year, or 18.6 percent of the total O&M costs on the main and tertiary canals. This amount does not, however, include the imputed value of the farmers' contribution in terms of labor. In the proposed level of O&M expenditures, farmers are expected to contribute a total of Rp 5,950/ha per year, consisting of Rp 2,490 in cash and in-kind, plus unpaid labor with an imputed value of Rp 3,460. The farmers' contribution at the tertiary level thus represents 28 percent of the combined O&M costs for the main system and tertiary canals. The proposed level of O&M expenditures would thus increase not only the total amount spent per hectare, but also the relative amount that would actually be used for the O&M of irrigation facilities compared with that earmarked for wages and salaries.

Control Over Expenditure Decisions

For main system O&M, aggregate expenditures are limited by the budget process. Negotiations between the central government and the provincial governments are important in this process, but the central government has had a major role in determining the aggregate level of O&M funds available to the provincial governments. Within the established budget limits, the provincial governments, through the provincial public works departments, exercise considerable control over expenditure decisions. Farmers are not involved in these decisions.

For O&M at the tertiary level, farmers' organizations and the local village government officials are responsible for the control of expenditures. As noted earlier in this paper (see section on expenditures for O&M), one consequence of this is the existence of considerable variability among projects in the levels and types of expenditures for tertiary O&M.

FARMERS' ABILITY TO PAY FOR IRRIGATION SERVICES

Effects of Price and Tax Policies

Output price policies. The Government of Indonesia has followed a pricing policy for rice which in many years has kept domestic prices lower than they would have been had unrestricted imports of

rice been permitted. The food price policies of the government have resulted in large food subsidies to consumers, amounting to Rp 170 billion in 1980/81, and Rp 310 billion in 1982.

The National Logistics Agency (BULOG) purchases stocks of rice in an effort to maintain minimum floor prices for rice at the farm level. The floor prices in nominal and in constant 1984 prices for 1976-1984 are shown in Table 2.13. In real terms, the floor price declined somewhat during the first half of the period, and remained relatively constant during the second half. The actual prices which farmers receive are frequently less than these official floor prices. It is reported that because of the difficulties associated with the rice surplus that Indonesia is currently experiencing, farmers often receive a price of only about Rp 100/kg for unmilled rice.

Table 2.13. Government floor prices for unmilled rice, Indonesia, 1976-1984.

Year	Floor price in current Rp/kg	Floor price in constant 1984 Rp[a]/ha
1976	68.5	221
1977	71.0	203
1978	75.0	193
1979	95.0	184
1980	105.0	158
1981	120.0	164
1982	135.0	171
1983	145.0	160
1984	165.0	165

[a]Current prices deflated by the Implicit GDP Deflator (Asian Development Bank 1985).
Source: PATANAS, PAE.

For 1981, a nominal protection coefficient of 0.63 for rice was estimated. This implies that the price farmers received for rice was only 63 percent of what they would have received under a policy of no restrictions on rice imports. Reductions in the world rice price since 1981 have reduced the extent to which the government floor price for unmilled rice is below the price that would correspond to free imports, so that the degree of nominal protection is nearer to 1.0. In 1982, it is likely that domestic prices were above the level that would have prevailed with unrestricted imports. Thus the effect of government price policy on the ability of the farmer to pay for irrigation services has been variable.

Price policies on inputs other than water. The most significant input price policy which affects the ability of Indonesian farmers to pay for irrigation is that for fertilizer. Fertilizer prices have been held at low levels as a production incentive to farmers. This has resulted in a significant subsidy to the farmers, thereby enhancing their ability to pay for irrigation services, and possibly offsetting the negative effects of the rice policy on their ability to pay.

The total amount of the fertilizer subsidy in 1980/81 was Rp 138 billion. The amount budgeted for 1981/82 was Rp 314 billion. Timmer (1985) notes that fertilizer prices have been dropping fairly sharply in real terms since 1976. His analysis suggests that although the fertilizer price policy represents a direct subsidy to the farmer, the effects of the subsidy have been economically beneficial to Indonesia. He argues that given the size of Indonesia's imports of rice over the past 15 years, and the nature of the international rice market, the subsidy has had the effect of lowering world rice prices, with resulting beneficial effects for Indonesia as a rice importer. To the extent that the fertilizer policy subsidy has resulted in lower rice prices than would otherwise prevail in Indonesia, the net positive effect of the subsidy on farm incomes is reduced.

Tax policies. The most important government tax policy affecting the farmers' ability to pay for irrigation services has been the land-based IPEDA tax (now being replaced by the Land and Building Tax). As the amounts collected from this tax are indirectly related to irrigation, it is discussed later in this paper in the section on indirect methods of financing irrigation services.

Irrigation Benefits

Under conditions typical for Indonesia, irrigation can be expected both to increase yields of rain-fed crops (mostly rice) and to increase cropping intensities. Measuring the incremental benefits due to irrigation is difficult, however, and only limited information is available.

In one study designed to examine the effects of the rehabilitation of the Pekalen Sampean Project, Taylor (1979) was unable to demonstrate any positive effect of rehabilitation on production. He also studied the overall effect of irrigation on production and farm incomes. He concluded that although irrigation increased yields, net income from an irrigated crop was approximately the same as from a nonirrigated crop, due to increased use of inputs. The major positive impact of irrigation on farm incomes was through its effect on cropping intensities, which were clearly higher in the irrigated areas than in rain-fed areas.

The Gadjah Mada University study calculated the incremental benefit directly attributable to irrigation in an attempt to assess the farmer-beneficiaries' capacity to pay. This was estimated by comparing farmers' net annual income in the irrigated area with incomes in a corresponding rain-fed area. Two irrigation systems were studied — the Pemali-Comal System in Central Java (representing projects characterized by diversified cropping and high cropping intensity) and the Bantimurung Lanrae System in South Sulawesi (considered typical of projects in the outer islands with rice-oriented cropping patterns and lower cropping intensities).

The net incremental benefits by farm size and type of irrigation system for these two irrigation areas are presented in Table 2.14. The results show that the incremental income from irrigation is higher for the technical irrigation systems than for the semitechnical or simple systems. In the technical systems, owner-operators received greater benefits than did sharecroppers. In the semitechnical systems, however, there was no consistent pattern in the differences in income between these two land tenure groups.

On the basis of the recommendation of the Gadjah Mada University study that Rp 21,100/ha per year is needed for "adequate" O&M, and taking Rp 8,000/ ha as the average IPEDA paid by farmers in irrigated farms, the farmers would have to pay an average of about Rp 29,000/ha per year in water-related charges if, in addition to IPEDA, an irrigation service fee were imposed to cover O&M costs for the main system O&M. Considering that the figures in Table 2.14 for the incremental net benefits of irrigation for owner-operators average to about Rp 175,000/ha, the charge of Rp 29,000 would be equivalent to approximately 17 percent of the average benefits. The payment to IPEDA (Rp 8,000/ha) plus the cash and in-kind payment by farmers at the tertiary level (Rp 2,490/ha)[2] amount to only 6 percent of the average incremental benefits.

Table 2.14. Incremental net benefit by farm size and type of irrigation system (Rp/farm).

Study area	Ownership pattern	Farm size (ha)	Type of irrigation system		
			Technical	Semitechnical	Simple
Pemali-Comal	Owner-operator	< 0.5	119009	58543	25397
		0.5 - 1.0	204301	133542	176602
		1.0 - 1.5	439875	625426	160074
		1.5 - 2.0	-	-	122781
		> 2.0	-	-	190737
	Share-cropper	< 0.5	45554	57307	42895
		0.5 - 1.0	66369	-	2849
		1.0 - 1.5	-	-	-
		1.5 - 2.0	-	-	-
		> 2.0	-	-	-
Bantimurung Lanrae	Owner-operator	< 0.5	53098	64650	-
		0.5 - 1.0	162498	54270	-
		1.0 - 1.5	304543	130497	-
		1.5 - 2.0	-	188068	-
		> 2.0	-	-	-
	Share-cropper	< 0.5	-	29867	-
		0.5 - 1.0	-	70852	-
		1.0 - 1.5	-	76824	-
		1.5 - 2.0	-	225632	-
		> 2.0	-	-	-

Source: Gadjah Mada University (1982).

The Gadjah Mada University study also estimated the "economic surplus" — the difference between the net annual income and the family's basic needs (taken as 300 kg of rice equivalent per capita per year). Given the farm size distribution in the areas studied, a total of 62 percent of the owners had no economic surplus. This implies that if the criterion of zero economic surplus is used as a cutoff point below which farmers would not be required to pay for irrigation services, only 38 percent of those served by the system would be contributing to O&M costs. While the Gadjah Mada University study does not assume that 38 percent of all irrigated rice farmers are able to pay for irrigation, it suggests the feasibility of a progressive system of irrigation service fees.

[2]This excludes the value of the farmers' labor contributions.

Farm production survey data from the Ministry of Agriculture, which compare production, costs of production, and net income per hectare for lowland and upland rice, are presented in Table 2.15. Net income per hectare derived from lowland rice is 2.2 times that from upland rice. While the total cost of production per hectare of lowland rice is 1.9 times that of upland rice, the yield of lowland rice is 2.1 times as much. The total value of the production from lowland rice is twice that obtained from upland rice.

Table 2.15. Farm income and cost of production data for lowland and upland rice, 1983/84.

	Lowland[a]		Upland[b]	
	Rp/ha/crop	% of total	Rp/ha/crop	% of total
Rent to land	134811	28.7	44898	18.2
IPEDA, Zakat[c], contribution to P3A, depreciation cost	27604	5.9	4487	1.8
Interest on credit	2236	0.5	872	0.4
Applied production inputs	48561	10.3	37584	15.3
Seeds	8116	-	9330	-
Commercial fertilizer	29423	-	17578	-
Compost	1641	-	5353	-
Pesticides	6259	-	3888	-
Herbicides	1267	-	281	-
Others	1855	-	1154	-
Labor	256421	54.6	158300	-
Family - 50.9/62.7 days[d]	63551	-	71370	-
Hired - 154.7/91.6 days	192870	-	86930	-
Total cost of production	469633	100.0	246141	-
Net income	272025	-	122966	-
Total value of production	741658	-	369107	-
Yield - 5668/2666 kg				
Price[e] - 130.85/138.45 Rp/kg				

[a]Average for 23 provinces, n = 439.

[b]Average for 17 provinces, n = 81.

[c]Islam tax.

[d]First number refers to lowland/second number refers to upland.

[e]Local market price.

Source: Directorate General of Food Crops (1984).

The components of the cost of production for both types of rice are also shown in Table 2.15. The fact that the rent to land is three times as high for lowland rice is an indication of substantial increases in the net returns resulting from irrigation. The category that includes taxes, depreciation, and contribution to the water users' association (P3A) is about Rp 23,000 higher for lowland rice, reflecting both the increased payment that farmers make directly for irrigation services (their contributions to the P3A), and the extent to which their general tax burden to the government (largely through IPEDA) is increased as a result of irrigation.

Provincial data on yield, cost of production, and income from the cultivation of lowland and upland rice are presented in Tables 2.16 and 2.17. As indicated by the national averages, on a per hectare

Table 2.16. Yield, cost of production, and income, lowland rice, by province, 1983/84.

Province	Yield	Value of yield	Cost of production		Income	
	kg/ha	Rp/ha	Rp/ha	Rp/kg	Rp/ha	Rp/kg
1. D.I.[a] Aceh	5530	863465	693085	125	170380	31
2. Sumatera Utara	5100	848693	516380	101	332313	65
3. Sumatera Barat	5905	830189	558013	95	272176	46
4. Riau	4413	700733	462394	105	238339	54
5. Jambi	7739	979760	541181	70	438579	57
6. Sumatera Selatan	4559	743178	345167	76	398011	87
7. Bengkulu	5533	825533	402457	73	423073	76
8. Lampung	10870	670373	372740	34	297633	27
9. Dki Jaya	-	-	-	-	-	-
10. Jawa Barat	5760	721257	516463	90	204794	36
11. Jawa Tengah	6326	775360	497406	79	277954	44
12. D.I.[a] Yogyakarta	4170	596280	365070	88	231210	55
13. Jawa Timur	5142	646160	425105	83	221055	43
14. Kalimantan Barat	4310	616270	393628	91	222642	52
15. Kalimantan Tengah	2140	360700	177970	83	182730	85
16. Kalimantan Selatan	7667	1016066	473272	62	542794	71
17. Kalimantan Timur	-	-	-	-	-	-
18. Sulawesi Utara	4887	926500	496480	102	430020	88
19. Sulawesi Tengah	4604	597000	356123	77	240877	52
20. Sulawesi Selatan	5280	688872	394167	75	294705	56
21. Sulawesi Tenggara	3500	472500	157000	45	320500	92
22. Bali	6358	762960	323750	51	439210	69
23. Nusa Tenggara Barat	5681	607343	419461	74	187882	33
24. Nusa Tenggara Timur	5012	666500	316286	63	350214	70
25. Maluku	-	-	-	-	-	-
26. Irian Jaya	-	-	-	-	-	-
27. Timor Timur	2000	280000	152500	76	127500	64
Average	5668	741655	469633	83	272022	48

[a]Irigasi or irrigation districts.

Source: Directorate General of Food Crops (1984).

basis, upland rice fields registered lower cost of production, yield, and income than in the case of lowland paddy fields. But the fact that production costs per kilogram of unmilled rice are similar suggests that while irrigation may not lower production costs per unit of output, it has the effect of extending the farmers' land resource base, making it possible and productive for him to continue to add nonland inputs into the production process. This is consistent with Taylor's (1979) finding cited in the previous section that the main effect of irrigation on income was to permit an intensified use of the land resource. Given the extremely small size of farm holdings in Java, this is an important mechanism for increasing farm incomes.

Table 2.17. Yield, cost of production, and income, upland rice, by province, 1983/84.

Province	Yield	Value of yield	Cost of production		Income	
	kg/ha	Rp/ha	Rp/ha	Rp/kg	Rp/ha	Rp/kg
1. D.I.[a] Aceh	-	-	-	-	-	-
2. Sumatera Utara	2190	430421	307450	140	122969	56
3. Sumatera Barat	1950	302500	265000	136	37500	19
4. Riau	1867	242667	117094	63	125573	67
5. Jambi	-	-	-	-	-	-
6. Sumatera Selatan	1700	319250	230555	136	28695	52
7. Bengkulu	1300	195000	152250	117	42750	33
8. Lampung	2670	332528	266024	100	66504	25
9. Dki Jaya	-	-	-	-	-	-
10. Jawa Barat	3030	246817	290739	96	5607	19
11. Jawa Tengah	3875	310000	291260	75	18740	5
12. D.I.[a] Yogyakarta	4627	592793	289631	63	303162	66
13. Jawa Timur	3088	378732	297668	96	81064	26
14. Kalimantan Barat	1650	381610	174240	106	207370	126
15. Kalimantan Tengah	-	-	-	-	-	-
16. Kalimantan Selatan	1600	280000	269800	169	10200	6
17. Kalimantan Timur	-	-	-	-	-	-
18. Sulawesi Utara	-	-	-	-	-	-
19. Sulawesi Tengah	2880	417500	301875	105	115625	40
20. Sulawesi Selatan	1003	119438	76628	76	42750	43
21. Sulawesi Tenggara	1200	240000	163400	136	76600	64
22. Bali	-	-	-	-	-	-
23. Nusa Tenggara Barat	3520	315400	205625	57	109775	31
24. Nusa Tenggara Timur	1000	334078	201632	202	132446	132
25. Maluku	-	-	-	-	-	-
26. Irian Jaya	-	-	-	-	-	-
27. Timor Timur	-	-	-	-	-	-
Average	2666	369106	246141	92	122965	46

[a] *Daerah Irigasi* or irrigation districts.
Source: Directorate General of Food Crops (1984).

To gain additional insight regarding questions of the farmers' ability to pay for irrigation services under alternative financing policies, we have developed a series of tables to compare the income

earned from irrigated agriculture relative to some minimally acceptable reference income level. The data are expressed in terms of the equivalent amount of unmilled rice. Because of the high proportion of irrigation in Indonesia which is located in Java, and because of the considerable differences in conditions between Java and the rest of Indonesia, the tables reflect typical conditions for Java, rather than for Indonesia as a whole.

Indicative costs and returns to irrigated rice production in Java, under current policies regarding payment for irrigation services, are presented in Table 2.18. These are based on the assumption of two rice crops per year, with a yield of 4.1 tons of unmilled rice/ha for the wet-season crop, and 3.2 tons/ha for the dry-season crop (Electroconsult Engineering 1985). In a situation of a farm family which owns all the land it farms, returns to family resources are estimated to be approximately 3,870 kg/ha.

Table 2.18. Indicative costs and returns to irrigated rice production in Java, Indonesia, 1985.

Item	Amount ('000 Rp/ha)	kg unmilled rice/ha	% of value of total production
Gross receipts	839.5[a]	7300[b]	100.0
Charges related to water			
Tertiary O&M (cash and in-kind)[c]	19.0	165	2.3
Tertiary O&M (labor)[c]	(2.0)	(17)	(0.2)
IPEDA[d]	8.0	70	1.0
Other purchased inputs excluding labor[b]	120.0	1043	14.3
Hired labor[b]	247.4	2151	29.5
Returns to family resources[e]	445.1	3871	53.0

[a]Based on a price of Rp 115/kg (Electroconsult Engineering 1985).

[b]Based on 2 crops/year, with a yield of 4,100 kg/ha for the wet season, and 3,200 kg/ha for the dry season (Electroconsult Engineering 1985:21).

[c]Based on data in Table 2.14, assuming only 2 crops (wet-season crop and first dry-season crop).

[d]Assumed to be Rp 8,000/ha, as also assumed in Table 2.21.

[e]If family owns all land farmed.

The effects of alternative policies regarding farmer payments for irrigation services are presented in Table 2.19. Retaining the current policies with respect to both IPEDA and tertiary O&M, but adding an irrigation service fee to cover the cost of main system O&M would reduce the estimated returns by approximately 2.0 percent to 3,801 kg/ha (Table 2.19:column 2). If in addition, farmers' payments were increased to recover fully the capital cost of irrigation, the current level of returns would drop 22 — 91 percent, depending on the level of investment cost (Table 2.19:columns 3-5).

Table 2.19. Hypothetical costs and returns to irrigated rice production in Indonesia, 1983, assuming changes in policies regarding water charges (kg unmilled rice/ha).

Item	Assumed policy on water charges				
	Actual policy[a]	Water charges raised to cover all O&M	Water charges raised to cover O&M plus 100% of capital cost, assuming initial capital cost level is		
			High	Medium	Low
Gross receipts	7300	7300	7300	7300	7300
Charges related to water					
Tertiary O&M (cash and in-kind)	165	165	165	165	165
Tertiary O&M (labor)	(17)	(17)	(17)	(17)	(17)
Main system O&M	0	70	70	70	70
IPEDA	70	70	70	70	70
Capital cost[b]	0	0	3434	1530	774
Other purchased inputs excluding labor	1043	1043	1043	1043	1043
Hired labor	2151	2151	2151	2151	2151
Returns to family resources[c]	3871	3801	367	2271	3027

[a]Figures from Table 2.18.

[b]Calculated from Table 2.20.

[c]If family owns all land farmed.

METHODS OF FINANCING IRRIGATION SERVICES

Direct Methods of Financing Irrigation Services

Historically, government policy has been: 1) that the government is to provide for the O&M of the main irrigation systems, with no direct charges for these services levied by either the central or the regional governments on the users of irrigation water, and 2) that the farmers and local communities undertake responsibility for O&M at the tertiary level. This policy can be traced in part to the Dutch policy of relying on a land tax (landrente) as a cost recovery measure for irrigation (by means of the higher taxes levied on irrigated lands). Given this history, the existence of a similar land-based tax (IPEDA or the new Land and Building Tax), may present a constraint to any change in policy in the direction of the introduction of direct government charges for irrigation services.

There currently exist, however, regulations which make it legally possible to levy direct charges on the users of irrigation services. Presidential Instruction No. 1 of 1969 authorizes the provincial governments to impose a levy on the beneficiaries of an irrigation system for the O&M of the system. Furthermore, Act No. 11 of 1974 states that while water is a gift from God, those who derive direct benefits from an irrigation project should be called upon to contribute towards the management service cost.

At the tertiary level, farmers make a variety of types of contributions in cash, in-kind (unmilled rice), or in the form of labor to provide resources for the O&M of the tertiary system. The collection of the required fees through the water users' association and village government is generally not a problem. Strong social pressures are exerted on members to pay, especially in the traditional water users' associations in Java and the *subaks* of Bali. It appears that the associations are successful in collecting the membership fees from the farmers because they are able to implement the regulations and impose the sanctions agreed upon by the farmer-members.

Indirect Methods of Financing Irrigation Services

IPEDA. For many years, the most significant indirect method of financing irrigation services in Indonesia has been a land-based tax, IPEDA.

Background. The taxation of land and property has a long tradition in the history of Indonesia, being in existence long before the period of the Dutch administration. From a tithe in-kind given by the peasants of Java and Bali to the landed aristocracy (*priyai*), the tribute became a land tax (landrente) paid for the use of the land to the colonial Dutch Government. Tariffs for the landrente varied between 8-20 percent of the value of average net yields of land, depending on transport and marketing facilities in a village (Kim 1981).

The first individual property tax (*verponding*) was introduced in 1928. Prior to that, the customary law in Indonesia (the *adat*), considered the right to land as a combination of several rights controlled by the community.

Ordinance No. 11 of 1959 established the tax on land production (Pajak Hasil Bumi). The tax was levied at a rate of five percent of the value of the net yield of the land. The revenue from the tax was for the financing of rural development projects. This ordinance authorized the Minister of Finance to approve a higher rate (not exceeding 10 percent) at the request of a local government. This authority, however, has never been exercised.

In 1965, administrative changes were made, and the Pajak Hasil Bumi was renamed Iuran Pembangunan Daerah. The name stresses the nature of the tax as a contribution (Iuran) to regional development (Pembangunan Daerah). Since 1965, this tax has been levied on all lands — rural, urban, estate, mining, and forestry. The following discussion of IPEDA focuses on the tax on rural land.

Assessment and collection. The assessment of the rate of tax to be paid by taxpayers is formally a responsibility of the Regional Inspectorates (*Kantor Wilayah IPEDA*) of the IPEDA Directorate. The current assessments are based on *Surat Keputusan Direktur Jenderal Pajak No. KEP-850/PJ.66/1979*, which refers to the classification of irrigated and rain-fed lands for rural IPEDA rates. In general, the IPEDA assessment is based on the productivity of the land (which is affected by the presence and quality of the irrigation system, soil condition, slope of the land, and location) and on the size of the landholding. Irrigated rice land has 15 productivity classes, each of which is divided into 5 farm-size categories. The tax rate increases according to the productivity of the land and the size of the landholding.

Although assessment and collection of IPEDA are formally the responsibility of the IPEDA Directorate, for the rural sector this tax is frequently collected by the village (desa) officials, who then remit the funds to the district through the subdistrict government (*Kecamatan*). The individual assessments are based on the certificates of ownership, which are kept at the village level. The village is allowed to keep 10 percent of the funds as an incentive for collection. In most cases, 10 percent of the remainder goes to the provincial government, 10 percent of the balance goes to purchase shares in the Regional Development Bank (on behalf of the district), and the remainder (72.9 percent of the total collected) goes to the district.

Relationship between IPEDA revenues and irrigation. Details on the revenues derived from irrigated rice fields are not readily available. It is therefore not clear to what extent IPEDA revenues have been increased as a result of irrigation. If the productivity classes into which land is assessed do not accurately reflect actual productivity differences, and if changes in productivity of land, such as are brought about by irrigation development, are not reflected reasonably promptly in changes in the category into which the land is placed for IPEDA assessment, then the link between irrigation development and the revenues from this tax may be weak.

Pasandaran (1985) cites a study by Sinulingga (1985) in the Cimanuk River Basin in West Java. This study found that there were relatively few significant differences in the actual productivity of land among samples taken from classes VII-XIV (the lower productivity classes). No data are available on the classes of land into which most of the irrigated land would fall. This suggests that reassessment of land may be needed before the collection of IPEDA will be closely linked to irrigation.

In his study in the Pekalen Sampean Project, Taylor (1979) collected information on the amounts of IPEDA payments of farmers of both irrigated and nonirrigated land in 1973-1974. The average payment for irrigated land was about Rp 5,300/ha per year (equivalent to about Rp 32,400 in 1984 prices), while the average payment for rain-fed land was only about Rp 800/ha (about Rp 4,900 in 1984 prices). This suggests that these payments may result in a substantial amount of indirect recovery of irrigation costs.

Utilization of IPEDA revenues. The IPEDA fund, as stipulated in Law No. 11 of 1959, is required to be used by the district for financing its rural development projects. A subsequent regulation in 1969 (Instruction No. 3 of the Minister of Home Affairs) identified the development projects to be composed of a) irrigation infrastructure, b) transport infrastructure like roads and bridges, c) flood control structures, and d) agricultural support services. An additional requirement imposed by the Ministry of Home Affairs (Instruction No. Ekbang 7/27/72 of 1972) is that 20 percent of the fund should be allocated for the maintenance of infrastructure created through the Inpres programs.

Except for the broad categories on the composition of the development projects, the *Bupati* (head of the district) has considerable discretion over the allocation of the 72.9 percent of IPEDA revenues he receives. The Gadjah Mada University study found that only a very small percentage of these revenues is spent on agricultural development, with only perhaps one percent spent for irrigation development.

In general, the IPEDA revenue is regarded solely as a development fund and not as a routine O&M fund, particularly in Java. It has also been observed that the Bupati is interested in making "visible" expenditures for political reasons and does not wish to allocate funds to a sector which is already supported by grants from the central or provincial governments. Because most of the other revenue sources directed to the district level are earmarked for specific purposes, the IPEDA revenues may be the only significant fund over which the Bupati may exercise his discretion.

Noncompliance with the objectives for the use of funds has been reported by Booth (1974). She states that development projects tended to be a residual category for the expenditure of IPEDA funds, with higher priority being given to items such as wages and salaries and vehicles and office equipment. Data on district budgets for 1978/79, developed from samples covering 69 percent of the population, indicate that total development expenditure on rural economic development projects was equivalent to only 76 percent of IPEDA revenue. This suggests that at least 24 percent was spent for purposes other than rural development.

Proposals for modifications in IPEDA. The structure of this tax as one designed to reflect the productivity of land has led to suggestions for modifications to make it finance irrigation O&M costs more satisfactorily. In recent loan agreements between the Government of Indonesia and the World Bank, attention has been given to three common items: assurance of provision of adequate funding for O&M, increased IPEDA revenues from beneficiaries of irrigated lands, and allotment of a portion of IPEDA for O&M costs of irrigation projects. Although the Land and Building Tax, which is based on the market value of the land (and thus indirectly on its productivity), is in one sense a response to the proposals for modification of IPEDA, this tax is likely to face many of the same problems that IPEDA has with respect to the financing of irrigation costs.

For example, one problem with IPEDA was that the land classification and assessment system needed updating so that assessments would more accurately reflect actual productivity conditions. This need for accurate and updated assessments will also remain under the Land and Building Tax.

Earmarking, for irrigation O&M expenditures, a portion of the additional IPEDA revenues generated as a result of irrigation development is another frequently made suggestion. Such an approach would have the advantages of providing a direct link between revenues and expenditures, and of using an existing collection mechanism which appears to be fairly efficient. To a limited extent, the Land and Building Tax may permit some earmarking, because some of the funds flow to the central government now. But at the district level, where decisions about expenditure of IPEDA revenues were made, and where decisions about the expenditure of much of the Land and Building Tax will be made, the Land and Building Tax has been seen as a major source of revenue for development activities. Earmarking a portion of these tax revenues for O&M would require significant policy changes which are likely to be resisted by the heads of the district government.[3]

[3]Subsequent to be preparation of this manuscript, the Government issued a statement of policies for irrigation O&M. In this statement it is noted that the Land and Building Tax may not be a dependable source of revenue for irrigation O&M because of the demands on the funds of this tax for regional and local development, particularly at the district level (National Development Planning Agency 1986).

Secondary Income of Water Users' Associations

Much of the information on financing of tertiary irrigation services in Indonesia focuses on the amount of direct payments by farmers. But many of the associations, particularly in Java and Bali, have mechanisms by which they can generate income from sources other than direct farmer payments. In some cases, the associations have the rights to income from a specified parcel of irrigated land. Officials of the association are allowed to cultivate or lease out the parcel and retain the income from it as compensation for their services. This secondary income reduces the amount of funds which the association needs to collect directly from the water users.

RELATIVE CONTRIBUTION OF FARMERS TO IRRIGATION FINANCING

If one ignores the indirect contributions to government finances that farmers make through IPEDA, farmers in government irrigation systems contribute a portion of the O&M costs (for the tertiary-level O&M); none of the capital costs are contributed by the farmers. The percentage of the total cost of irrigation services which is thus borne by farmers depends primarily on the size of the investment costs and the size of the tertiary-level O&M cost. Some crude estimates, based on "typical" values for investment costs and tertiary-level O&M costs are presented in Tables 2.20 and 2.21. Using the

Table 2.20. Hypothetical annualized cost of irrigation services, by size of investment and amount of expenditures on tertiary-level O&M (Rp/ha).

	Size of investment		
	High	Medium	Low
Construction cost	3000000[a]	1500000[b]	800000[c]
Interest during construction[d]	916000	248000	84000
Total capital cost	3916000	1748000	884000
Annualized value of capital cost	395000	176000	89000
O&M cost main system	8000	8000	8000
Subtotal (capital cost plus main system O&M)	403000	184000	97000
Total annualized cost if tertiary-level O&M costs are:			
Rp 3000/ha	406000	187000	100000
Rp 15000/ha	418000	199000	112000
Rp 30000/ha	433000	214000	127000

[a]Represents typical level of investment for technical irrigation systems.

[b]Represents typical level of investment for semitechnical irrigation systems.

[c]Represents typical level of investment for small irrigation systems.

[d]Assuming a 5-year construction period for projects with high investment costs, 3 years for medium-cost projects and 2 years for low-cost projects, average investment equal to 50 percent of construction cost, and 10 percent interest.

moderate level of tertiary-level O&M costs of Rp 15,000/ha, the estimated portion of the total cost of irrigation services paid by farmers ranges from 3.6 percent in the case of investment costs typical of technical irrigation systems to 13.4 percent in the case of investment costs typical of small irrigation systems (Table 2.21).

Table 2.21. Percentage of hypothetical annualized cost of irrigation services borne by farmers.

Basis for calculation	Size of investment		
	High	Medium	Low
Direct farmer payments only			
Low tertiary O&M cost (Rp 3,000/ha)	0.7	1.6	3.0
Moderate tertiary O&M cost (Rp 15,000/ha)	3.6	7.5	13.4
High tertiary O&M cost (Rp 30,000/ha)	6.9	14.0	23.6
Direct farmer payments plus IPEDA[a]			
Low tertiary O&M cost (Rp 3,000/ha)	2.7	5.9	11.0
Moderate tertiary O&M (Rp 15,000/ha)	5.5	11.6	20.5
High tertiary O&M cost (Rp 30,000/ha)	8.8	17.8	29.9

[a]Assuming that the increase in IPEDA due to irrigation is equal to main system O&M cost of Rp 8,000/ha.
Source: Calculated from Table 2.20.

A more complete estimate results from adding to the direct contributions of farmers the indirect farmer contribution to government finances resulting from the increased IPEDA payment due to irrigation. These estimates are shown in the bottom half of Table 2.21, assuming that this increase in the IPEDA averages Rp 8,000/ha (a figure equal to the assumed O&M cost for the main system). Again, considering the moderate level of tertiary-level O&M costs, the estimated portion of total costs paid by the farmers ranges from 5.5 percent in large ("technical") systems to 20.5 percent in small systems. These figures (bottom half of Table 2.21) represent the contribution of the farmers to the total cost of irrigation services when the farmers' contributions are equal to the entire cost of the system O&M but with no contribution to the recovery of the capital costs.

EVALUATION OF FINANCING POLICIES

Efficiency in Water Use

The methods of financing used in Indonesia generally provide few incentives for the efficient use of water. The direct charges which farmers pay for irrigation services are those paid to local government officials for irrigation services or payments to the local water users' association. These payments are typically based on the area served, with perhaps some distinction made between rice and other crops. The farmer payment for IPEDA, which could be considered an indirect charge for irrigation services, is also not affected by the efficiency with which the farmer uses irrigation water.

Although financial policies do not encourage efficiency of water use by farmers, it has been observed in some irrigation systems in Indonesia that efficiency of water use is quite high in the seasons when

water is scarce. For example, Taylor (1979:120) noted that "remarkably efficient use of scarce land and water resources is reflected in high cropping intensities, carefully monitored and modest application of irrigation water to secondary crops, and generally careful decision making on the allocation and distribution of irrigation water in the project area." Although Taylor's study was limited to one project in East Java, studies of several small irrigation projects in Central Java also suggest high levels of efficiency in water use.

It seems reasonable to hypothesize that the critical factors leading to efficient water use have been the high opportunity cost of scarce irrigation water and the decentralized institutional structure for operating the irrigation systems at the tertiary level. This decentralized structure, which provides for irrigation operations to be controlled by the local village officials or by a local water users' association, seems to provide the necessary incentives and structure for efficient water use.

Efficiency in Investment

The mechanisms for financing ongoing irrigation services are not linked to the procedures by which investment decisions in irrigation are made, and thus provide no direct opportunity to affect the efficiency of investment decisions. It appears that at least in the past, the methods and levels of O&M financing frequently led to the neglect or deferral of ordinary maintenance. The result has been an increased need for investment in rehabilitation. Although such an approach to the provision of irrigation services is widely condemned by irrigation specialists, whether or not this has been an inefficient strategy could only be determined on the basis of detailed research into the specific consequences of gradual system deterioration.

Efficiency in Management

In discussing the management of irrigation systems in Indonesia, a distinction must be made between the management of the main systems by the provincial public works departments, and the management of the tertiary systems by local government officials and farmers through water users' associations.

The methods for financing irrigation services in Indonesia do not provide any financial accountability between the water users and the government agencies operating the main systems. Lines of accountability for the operational field staff extend upward to the provincial public works departments or to the special project offices. From these departments, lines of accountability extend both to the Provincial Governor's Office and to the DGWRD. These dual lines of accountability complicate the context within which control of O&M activities and expenditures takes place.

Another important factor affecting the efficiency with which the irrigation systems are managed is the amount of funds made available for O&M. For main system O&M in Indonesia, funding is provided through a process that involves centralized budget decisions that are unrelated to any form of revenue generation resulting from irrigation. In such a situation the question arises as to how

budget decisions are reached, and whether the funds provided are adequate for the efficient provision of irrigation services. It seems clear that in the past, funding for O&M has been inadequate to maintain high-quality irrigation services to the farmers. Although funding levels have increased substantially in recent years, they remain well below the level "needed" according to DGWRD calculations. Furthermore, the level of funding provided relative to DGWRD estimates of need appears to vary considerably among the provinces.

At the tertiary level, the situation is quite different. The decentralized nature of the operational responsibility for the tertiary systems, and the need for substantial financial contributions from the water users create significant financial linkages between water users and managers. The very term which is used in Indonesian for the payment to the local village officials (*pangrasa*, which literally means "feeling") emphasizes this linkage. While in some cases the payments are in the form of fixed charges or "taxes," in other cases either a portion or all of the amount paid is a "feeling" payment, with the amount paid by a farmer dependent on his feelings regarding the quality of the services received, and the outcome in terms of crop production (Taylor 1979). These financial linkages are also accompanied by strong social linkages that exist between the users and those who manage the systems at the tertiary level. It is probable that this combination of strong social and financial linkages enhances the efficiency of operation of the irrigation systems at the tertiary levels.

Income Distribution between the Public and Private Sectors

Irrigation in Indonesia clearly involves a net expenditure of public funds. Outflows of public funds are associated with the construction of new systems, the rehabilitation of deteriorated systems, and the O&M of main systems, including salaries for staff involved in main system O&M. The only significant inflow of public funds resulting from irrigation is IPEDA. Although data are available on the total amount of IPEDA funds generated by rural land (Table 2.22), the extent to which irrigation has contributed to the collections of this tax is not known.

It is thus not possible to determine with precision the net flow of public funds associated with the normal O&M of irrigation systems. Some indication, however, of the magnitudes involved can be gained by comparing the total amounts of the central government grants for O&M (from Table 2.5) with the total IPEDA collections from the rural sector. This comparison is presented in the first column of Table 2.22. Central government grants for O&M have increased in the years since 1979/80 more rapidly than the increase in funds generated by the rural IPEDA. As a result, these grants are now equivalent to nearly 90 percent of the total amount of rural IPEDA funds, as compared to about 43 percent in 1979/80. It seems unlikely that the proportion of the revenues from this tax attributable to irrigation is as high as 90 percent. If one considers rehabilitation to be another (deferred) form of O&M, then the relevant comparison would be the total grants for both O&M and rehabilitation relative to the total rural IPEDA revenues (Table 2.22:column 2). Although there has been some year-to-year fluctuations, these grants have been approximately equal to the total IPEDA revenues from rural land since 1981.

Table 2.22. Ratios of central government grants under the Local Government Development Program to IPEDA collections from rural lands, 1979/80-1984/85.

Year	O&M grants only[a]	O&M grants plus irrigation rehabilitation grants[b]	Total grants for fixed programs[c]	Total, all Local Government Development Program grants[d]
1979/80	0.43	0.63	0.89	3.29
1980/81	0.61	0.83	1.53	5.11
1981/82	0.72	1.00	1.82	5.94
1982/83	0.79	1.08	1.96	6.38
1983/84	0.72	0.92	1.69	5.53
1984/85	0.89[e]	n.a	n.a	n.a

[a]Ratio of grants for irrigation O&M (including swamplands and rivers) to IPEDA revenues from rural lands.

[b]Ratio of grants for irrigation O&M plus grants for rehabilitation of irrigation systems to IPEDA revenues from the rural lands.

[c]The fixed programs in the Local Government Development Program include grants for irrigation O&M, rehabilitation of irrigation systems, and rehabilitation of roads and bridges.

[d]Includes all fixed programs plus the discretionary, or nonfixed grants.

[e]Includes the direct grant of the sectoral budget, from the central government to the provincial public works departments.
Sources: IPEDA Directorate (1985) and DGWRD (1984).

Given the financing policies and mechanisms followed in Indonesia, however, it is somewhat artificial to attempt to determine the net flow of funds associated with normal O&M of irrigation systems. IPEDA is a tax to fund the rural development activities of local governments. It is not a tax to fund irrigation development specifically (although this is one of several types of rural development that may be allocated money through the funds of this tax), and it is definitely not a tax to fund irrigation O&M.

It is thus more relevant to consider the inflows to the local governments of funds from IPEDA in relation to the grants (outflows) which the central government provides to the local governments to supplement the ability of these governmental units to undertake rural development activities. These grants (or "subsidies" to the local governments, as they are called in Indonesia) were originally intended to be temporary, until the local government units could generate adequate funds from their own tax sources to support such activities fully.

One such comparison, using only the central government grants which are earmarked for specific rural development activities (irrigation O&M, rehabilitation of irrigation systems, and rehabilitation of roads and bridges), is shown in the third column of Table 2.22. In recent years, the total government grants earmarked for these rural development activities have been 1.7-2.0 times as much as total rural IPEDA revenues.

A second comparison based on all grants from the central government for the Local Government Development Program (including both the earmarked grants and the grants for discretionary activities), is given in the last column of Table 2.22. The total funds provided by the central

government for these programs has been five to six times as large as the amount of funds collected from the rural IPEDA. Even if IPEDA revenues from other sources are included (because all of the discretionary funds are not used to support rural development activities), the grants have been 1.8-2.4 times as much as the revenues from this tax (Table 2.23:last column).

Table 2.23. Ratios of central government grants under the Local Government Development Program to total IPEDA collections, 1979/80-1983/84.

Year	O&M grants only[a]	O&M grants plus irrigation rehabilitation grant[b]	Total grants for fixed programs[c]	Total, all Local Government Development Program grants[d]
1979/80	17.9	26.2	37.4	137.6
1980/81	21.8	30.0	55.1	183.9
1981/82	27.2	37.8	69.1	224.9
1982/83	29.7	40.8	73.8	240.5
1983/84	23.9	30.6	56.1	183.9
Average	24.1	33.1	58.3	194.2

[a]Ratio of grants for irrigation O&M (including swamplands and rivers) to total IPEDA revenues.

[b]Ratio of grants for irrigation O&M plus grants for rehabilitation of irrigation systems to total IPEDA revenues.

[c]Ratios of Local Government Development Program fixed grants to total IPEDA revenues. Fixed grants include grants for irrigation O&M, irrigation rehabilitation, and rehabilitation of roads and bridges.

[d]Ratio of all Local Government Development Program grants to total IPEDA revenues. These grants include fixed program grants plus discretionary grants.

Sources: IPEDA Directorate (1985) and DGWRD (1984).

It is thus clear that government development policy results in a net outflow of public funds to local governments for rural development activities. In addition, construction of many new projects is funded and controlled centrally. This represents an additional outflow of public resources for which there is no significant offsetting inflow. The net outflow of funds for rural development activities (including irrigation) is consistent with the broad framework of Indonesia's development policies. With major policy objectives of moderate and stable food prices and self-sufficiency in rice, the Government has provided large subsidies for food and fertilizer. In 1981/82, the food subsidy (which tended to depress farmer prices and discourage production) was Rp 310 billion, and the fertilizer subsidy (which tended to offset the negative production effects of the food subsidy) was Rp 314 billion. In the same year, central government expenditures for capital investment in irrigation amounted to Rp 335.2 billion, while expenditures for irrigation O&M were Rp 26.1 billion. Thus the total irrigation O&M grants by the central government amounted to only about 8.3 percent of the fertilizer subsidy, and only 4.2 percent of the combined food and fertilizer subsidies. If funding for irrigation O&M has been inadequate, it would appear that the problem lies less in the area of the total availability of resources to the central government than it does in the process by which budgetary priorities are established.

Income Distribution within the Private Sector

Indonesia's policy of providing irrigation services without any direct charges for these services has sometimes been supported on the grounds that it helps the rural poor. It can be regarded as a transfer from the general taxpayer to the farmers in irrigated areas. Considering the small size of many farms, particularly in Java, this may be regarded as a desirable income distribution effect. Furthermore, the intensification of land use (double and triple cropping) resulting from irrigation increases the demand for rural labor, which has a positive impact on the income of landless laborers.

On the other hand, if the income from irrigated land is reduced because of poor O&M of irrigation systems stemming from the politically determined funding constraints associated with the method by which O&M is financed, then the income transfer mechanism may actually be limiting rather than enhancing rural incomes.

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Financing Irrigation Services in the Republic of Korea

Leslie E. Small and Marietta S. Adriano

FINANCING IRRIGATION SERVICES IN THE REPUBLIC OF KOREA

INTRODUCTION

Agriculture and the Korean Economy

The gross national product (GNP) of the Republic of Korea increased from US$61.2 billion in 1980 to US$81.1 billion in 1984, an increase of 32.5 percent. Per capita GNP grew at an average of 5.35 percent/annum from US$1,605 to US$ 1,998 during the same period.

The shares of agriculture, forestry and fisheries, manufacturing and mining, and other industries in the total GNP from 1980 to 1984 are shown in Table 3.1. The contribution of agriculture, forestry, and fisheries to the GNP, at current prices, averaged 14.6 percent from 1980 to 1984, while manufacturing and mining averaged 29.8 percent. The total contribution of all other industries averaged 55.2 percent of GNP during the same period.

Table 3.1. GNP and its industrial origin, 1980-1984.

	1980	1981	1982	1983	1984
GNP (US$ billion)	61.2	67.2	70.8	75.1	81.1
Per capita GNP (US$)	1605.0	1735.0	1800.0	1880.0	1998.0
GNP (billion won, at current prices)	37205.0	45775.1	51786.6	58428.4	65345.0
Agriculture, Forestry, and Fisheries	5372.5 (14)[a]	7403.1 (16)	7680.3 (15)	8301.2 (14)	9095.9 (14)
Manufacturing and mining	11226.5 (30)	13804.6 (30)	15255.3 (29)	17170.2 (29)	20035.5 (31)
Others	20606.0 (55)	24567.4 (54)	28851.0 (56)	32957.0 (56)	36213.6 (55)

[a]Figures in parentheses are percentages of total GNP.

Sources: Bank of Korea (1984) and National Bureau of Statistics (1985).

As a result of the rapid growth in the manufacturing and services sectors, the agriculture sector has been declining in relative importance since the early 1960s. The contribution of agriculture, forestry, and fisheries to GNP fell from 44 percent in 1961 to 14 percent in 1984. The contribution of the agricultural sector to foreign exchange earnings fell from 25 percent in 1965 to only 4 percent in 1983. The proportion will decline further despite increases in agricultural and fisheries exports due to the continuing rapid growth of manufacturing exports (World Bank 1984b).

The Republic of Korea has a land area of 9,909,000 hectares (ha). Use of national land by type of land is given in Table 3.2.

Table 3.2. Use of national land, 1983.

Type of land	Area (ha)	% of total land area
Cultivated land	2167000	21.9
Rice fields	1316000	(13.3)
Upland	851000	(8.6)
Forest land	6547000	66.1
Wooded	6282000	(63.4)
Denuded	240000	(2.4)
Uninvestigated	25000	(0.3)
Others	1195000	12.0
Total forest and other land	7742000	78.1
Total national land	9909000	100.0

Source: Ministry of Agriculture (1984).

The use of cultivated area by various food crops is given in Table 3.3. Rice is planted in 1.23 million ha, which is about 57 percent of the total cultivated area — 63.8 percent of the total area is used for food crops. The area, yield, and production of lowland rice and upland rice are presented in Table 3.4. On average, yield and production of lowland rice have decreased compared to 1978 and 1979, but lowland rice yields in the Republic are high by international standards. The yield and production of upland rice have been rather erratic due to the absence of irrigation in upland areas and to the lack of improved varieties.

A World Bank report predicts that given the relatively high average national income and consumption levels, demand for agricultural products is unlikely to expand much faster than the population growth rate (World Bank 1984b). The principal food in the Korean diet is rice, which represents 33 percent of the total food consumption by weight. Other grains comprise a further 16 percent of total food consumption.

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Table 3.3. Land use for food crops, 1971-1983 ('000 ha).

Year	Total cultivated land	Total area of food crops	Area planted to individual crops as percent of total area planted to food crops				
			Rice	Barley & wheat	Miscellaneous grains	Pulses	Potatoes
1971	2271	2560	52.4	33.8	4.4	14.9	7.2
1972	2242	2542	53.1	34.7	3.8	15.2	6.6
1973	2241	2494	52.7	31.8	4.1	16.5	6.2
1974	2238	2477	53.8	33.3	3.3	14.9	5.4
1975	2240	2531	54.4	34.0	3.3	14.9	6.5
1976	2238	2482	54.3	33.6	3.0	14.0	6.1
1977	2231	2294	55.1	24.5	2.9	14.6	5.7
1978	2222	2286	55.3	25.9	2.5	14.1	5.1
1979	2207	2143	55.9	22.2	2.2	12.5	4.3
1980	2196	1994	56.2	16.4	2.4	11.6	4.2
1981	2188	2012	55.9	17.1	2.3	12.4	4.2
1982	2408	1908	54.5	15.6	2.6	11.1	3.7
1983	2167	1926	63.8	18.2	2.2	12.1	3.8

Sources: Ministry of Agriculture and Fisheries (1982) and National Agricultural Cooperative Federation (1984).

Table 3.4. Area, yield, and production of lowland and upland rice, 1978-1983.

Year	Total rice[a]			Lowland Rice			Upland rice		
	A	B	C	A	B	C	A	B	C
1978	1229750	4.71	5797128	1219071	4.74	5779142	10679	1.68	17980
1979	1233234	4.51	5564808	1224157	4.53	5545763	9077	2.10	19045
1980	1233308	2.88	3550257	1219841	2.89	3529540	13197	1.57	20717
1981	1223892	4.14	5062975	1212258	4.16	5039557	11634	2.01	23418
1982	1188073	4.36	5175073	1175964	4.38	5105963	12109	1.99	24210
1983	1228481	4.40	5404045	1219645	4.42	5387740	8836	1.85	16305

A = planted area (ha); B = yield (tons/ha); C = production (tons).

[a]Unless otherwise specified, "rice" refers to "unmilled rice."

Source: National Agricultural Cooperative Federation (1984:28).

The country's population of nearly 40 million is growing at a rate of 1.6 percent/year. Its population density of 400/square kilometer (sq. km) and 18.2/ha of farmland is one of the world's highest (World Bank 1984b). As a result the land made available for agriculture is intensively developed. The government, in addition to irrigation and land consolidation, has invested in the reclamation of agricultural land from forests and tidal flats.

The average size of cultivated land per farm household was about 1.1 ha in 1983 (Ministry of Agriculture and Fisheries 1985:70). Farm households with less than 1 ha, however, accounted for 66

percent of total farm households (Table 3.5). With farm population comprising about 23 percent of the total population, agriculture plays a significant role in the economy as a major source of employment and income for the rural population.

Table 3.5. Distribution of Korean farm households, by size of cultivated land, 1983.

Size category	Total no. of farm households ('000)	% of farm households
< 0.5	571	29.3
0.5 - 1.0	719	36.9
1.0 - 1.5	392	20.1
1.5 - 2.0	160	8.2
> 2.0	106	5.5
Total	1948	100.0

Souce: Ministry of Agriculture and Fisheries (1984:32-33).

Agriculture and the Fifth Economic and Social Development Plan

In the Fifth Five-Year Economic Development Plan (1982-1986) and the Revised Economic and Social Development Plan (1984-1986), the government's primary objectives for the agricultural sector were national food security, income equity for rural families, and price stability. The food security objective requires full self-sufficiency in the staple foods of rice and barley. Rural income equity, which calls for maintaining rural family incomes equal to those of urban households, is seen as a necessary condition for maintaining high agricultural output, moderating rural-urban migration, and maintaining political stability. For price stability, the government seeks to reduce seasonal and year-to-year fluctuations in agricultural commodity prices, to support producer prices at levels sufficient to give strong production incentives and to assure consumers low prices for staple foods (World Bank 1984b).

During the 1982-1986 Plan period, agricultural productivity was projected to increase at an average annual rate of 3.5 percent. The rate of use of farmlands was targeted to increase 134 percent. Annual rice production is estimated to increase from 5.1-5.9 million metric tons. With this increase in production, rice imports will be reduced or eliminated.

Average annual farm household income is projected to rise at an average rate of 9.8 percent, from the 1981 level of 3,687,000 won to 5,481,000 won in 1986. Nonfarm income of farm households is estimated to increase even more rapidly, at an average annual rate of 14 percent.

Other government projections of change in the agricultural sector during the Fifth Plan (1982-1986) include a decline in the agricultural labor force and an improvement in the quality of arable land through increased irrigation and land consolidation, increased agricultural mechanization and use of fertilizer and other farm chemicals, and increased production of various crops.

A total of 4,600 billion won (at 1980 prices) is to be invested in the agriculture sector, with 1,490 billion won (32 percent) for the development of agricultural infrastructure. The policy of the government on the expansion of the agricultural production base centers on the development of water resources needed to irrigate the rice fields to increase the supply of food grains. About 76 percent of the rice fields are projected to be irrigated by the end of the Plan period (1986).

Irrigation Systems Development

Irrigation of lowland rice in the country is largely a matter of supplementing the relatively abundant but somewhat erratic rainfall. Generally one irrigated crop of rice is grown per year, although either barley or vegetables may be grown without irrigation (or with some irrigation provided by individual farmers) during the winter months. Early transplanting is important in obtaining high yields, and is frequently facilitated by irrigation.

There are several types of agencies which are responsible for the provision of irrigation services in the Republic of Korea. The Agricultural Development Corporation (ADC) is a semi-autonomous government corporation responsible for the planning, design, and construction of all large-scale irrigation projects (over 5,000 ha) for irrigation and comprehensive agricultural development (including tideland reclamation, drainage, and land development), and for the survey, design, and supervision of construction for medium-scale irrigation projects (50-5,000 ha). Farmland Improvement Associations (FLIAs), of which there are currently 103, are semi-autonomous organizations supervised by the Ministry of Agriculture and Fisheries and by the provincial governments. FLIAs are responsible for the operation and maintenance (O&M) of both medium- and large-scale irrigation projects, and for the construction (with assistance from the ADC) of supplemental facilities in existing irrigated areas, and in some cases, for the construction of new medium-scale irrigation projects. The members of the FLIA are the farmers in the service areas. The managing staff, who are nonfarmers, are appointed by the chairman of the FLIA. The chairmen are appointed either by the provincial government (in the case of FLIAs with less than 5,000 ha), or by the Ministry (in the case of FLIAs with more than 5,000 ha).

All the FLIAs are members of the Federation of Farmland Improvement Associations. The federation provides specialized services to the FLIAs. One of these services is related to land consolidation. The federation provides technical assistance in the planning for land consolidation, legal assistance regarding the realignment of landholdings, and implements land consolidation at the request of the member FLIAs. A second service is the provision of a management fund for FLIAs which need to borrow funds on a short-term basis to cover their operating costs. The source of this fund is reserve funds deposited with the federation by the financially stronger FLIAs. A third service involves a fund for the repair of irrigation facilities. Finally, the federation acts as an intermediary for the FLIAs in obtaining low-cost supplies such as cement and iron from the government office of supply.

Provincial and county (*gun*) governments provide subsidies for part of the cost of construction of small-scale irrigation projects (less than 50 ha). These projects are operated and maintained by

voluntary organizations of farmers who have land in the area served by the irrigation facilities. These irrigation groups ("literally, farmland improvement groups") generally do not hire any professional management staff. County and city governments provide some supervision over the financial activities of these groups. According to the ADC, there are over 15,200 such irrigation groups throughout the country; the currently active number, however, is not known.

For large-scale irrigation projects, coordination between the ADC, which is the implementing agency for construction, and the local FLIAs, which are ultimately responsible for their operation, is necessary. Prior to 1980, the ADC turned over to the local FLIAs all the constructed facilities of the project soon after the completion of construction. Since then, facilities of newly constructed projects have been first operated and maintained by the ADC for two to five years prior to being turned over to the local FLIA. During this period, the ADC repairs or rehabilitates the facilities if defects are found, and also trains the staff of the FLIA responsible for the O&M of facilities.

Information related to the importance of irrigation in Korea is presented in Table 3.6. Approximately 930,000 ha, or 71 percent of the total area of rice is irrigated. The remaining 29 percent is classified as "partially irrigated" rice. Historically, the total area irrigated by small-scale irrigation projects has accounted for considerably over half of the total irrigated area. Between 1974 and 1983, however, the area irrigated by the medium- and large-scale irrigation projects grew by a total of 35 percent, while the area irrigated by small-scale irrigation projects increased only by about 9 percent. Thus by 1983, of the 930,000 ha of irrigated rice, 51 percent was irrigated by small-scale irrigation projects operated by thousands of irrigators' groups, 17 percent was irrigated by medium-scale irrigation projects operated by 72 FLIAs, and 32 percent was irrigated by large-scale irrigation projects operated by 31 FLIAs.

Table 3.6. Status of irrigation in rice fields in the Republic of Korea.

Year	Total Area of rice ('000 ha)	Irrigated rice			Irrigated rice as % of total rice		
		FLIA ('000 ha)	Non-FLIA ('000 ha)	Total ('000 ha)	FLIA	Non-FLIA	Total
1974	1269	338	433	771	27	34	61
1975	1277	363	426	790	28	33	62
1976	1290	377	428	805	29	33	62
1977	1303	399	435	834	31	33	64
1978	1312	418	441	860	32	34	66
1979	1311	420	447	867	32	34	66
1980	1307	424	469	893	32	36	68
1981	1308	432	476	908	33	36	69
1982	1312	444	473	917	34	36	70
1983	1316	458[a]	471	930	35	36	71

[a]Consisting of 298.000 ha under large-scale irrigation projects (over 5,000 ha) and 160,000 ha under medium-scale irrigation projects (50-5,000 ha).

Source: Ministry of Agriculture and Fisheries (1984:35).

Irrigation projects in the Republic are not easily classified as "gravity" or "pump" projects. Many projects involve both pumps and reservoirs, and water is pumped into a canal or a reservoir frequently. Some idea of the areas served by different types of facilities, however, is given in Table 3.7. For medium-and large-scale irrigation projects, most of the area is served either by reservoirs (71 percent of the area) or by pumping facilities (26 percent). For small-scale irrigation projects operated by the irrigation groups, pumps (including tube wells) are much less important, accounting for only about 13 percent of the area irrigated. The most common facilities are small reservoirs (accounting for about one-third of the irrigated area) and diversion weirs (serving about one-fourth of the area). A variety of other types of facilities account for over a quarter of the area irrigated by these small-scale irrigation projects.

Table 3.7. Area of rice fields by irrigation facilities, 1983.

Type of irrigation facilities	Total benefited area		Medium and large projects (FLIA)		Small projects (irrigators' group)	
	ha	%	ha	%	ha	%
Irrigated area	928400	100.0	458800	100.0	469600	100.0
Reservoir	478100	51.5	325800	71.0	152300	32.4
Pumping/drainage station	162200	17.5	117800	25.7	44400	9.5
Weir	121200	13.1	11900	2.6	109300	23.3
Infiltration gallery	23600	2.5	2600	0.6	21000	4.5
Tube well	14700	1.6	0	0.0	14700	3.1
Other facilities	128600	13.9	700	0.2	127900	27.2

Source: Agricultural Development Corporation (1984).

In general, very little systematic information is available on the small-scale irrigation projects. The most useful information comes from a study by Oh (1978), who surveyed 64 small-scale reservoir projects of less than 50 ha each, and reported on the methods of organization, rules of water distribution, and assessment of costs in these projects. In the absence of additional systematic information on these projects, the remainder of this paper will focus mainly on procedures for the medium- and large-scale irrigation projects which are managed by the FLIAs.

GENERAL POLICIES REGARDING IRRIGATION FINANCING

There are four key elements in Korea's policies related to financing irrigation services. The first element is a network of decentralized, semi-autonomous agencies (FLIAs and irrigation groups) responsible both for providing irrigation services through the operation of irrigation facilities, and for collecting revenues from the users of these services. The second element, which applies to medium- and large-scale irrigation projects, is the provision of construction and development services through a centralized agency (the ADC) authorized to charge the decentralized agencies representing the

water users (FLIAs) for the cost of these services. The third element is the provision, from general tax revenues channeled through the budget of the Ministry of Agriculture and Fisheries, of subsidies to the FLIAs. These subsidies are generally limited to portions of the costs of capital development although in some unusual cases they may extend to O&M costs. The fourth element is a system of pricing policies which reduces the financial burden which would otherwise be placed on the users of irrigation services. The critical price policies are those for rice and for electricity.

The general financing principle for irrigation projects is that the water users are responsible for the entire O&M costs, plus some portion of the capital development costs.

The nominal magnitude of the subsidy provided by the central government for capital costs varies from 70-85 percent, depending on the size of the project and the type of facility constructed. Land consolidation and land reclamation activities receive nominal subsidies of only 50-80 percent from the central government; an additional 20-30 percent subsidy for land consolidation, however, is given by the local government. Local governments also provide additional subsidies for small-scale irrigation projects (Table 3.8).

Table 3.8. Nominal rates of subsidy for capital costs, by type of project.

Type of project	Nominal rates(%) of subsidy from		
	Central government	Provincial government	Total
Medium- and large-scale irrigation (FLIA):			
Reservoirs	70	0	70
Pumping stations	85	0	85
Small-scale irrigation (non-FLIA)	70	20	90
Farmland consolidation:			
Large scale	50	30	80
Medium scale	60	20	80
Drainage	85	0	85
Land reclamation:			
Tidal	80	0	80
Other	60	0	60

Source: Agricultural Development Corporation (1985).

For medium- and large-scale irrigation projects, the amount of capital costs to be repaid by the water users is financed by long-term loans from the central government channeled to the FLIAs through the National Agricultural Cooperative Federation — a semi-autonomous government organization under the general supervision of the Ministry of Agriculture and Fisheries. The loans are provided at

a subsidized rate of interest of 3.5 percent.[1] Certain costs, such as for survey and design, and for supervision of construction of large-scale irrigation projects are fully subsidized by the government.

High rates of inflation and rising real costs of construction have led, over time, to sharp differences in the farmers' repayment burden between older and newer FLIAs. This difference, and the increasingly high financial burden placed on water users in the newer irrigation facilities, has led the Ministry to establish ceilings on the irrigation service fees. As the fees of all FLIAs have distinct components for O&M and for repayment of capital costs, separate ceilings have been set for each component. Although the fees are denominated and paid in cash, the ceilings have been established in terms of rice at the official government purchase price. For the component of the irrigation service fee for O&M, the ceilings established by the Ministry are 250 kg rice per hectare for areas irrigated by reservoirs, 300 kg/ha for areas served by pumping stations, and 350 kg/ha for areas served by pumping and drainage stations.

The ceiling on the component of the irrigation service fee for capital repayment has been set, since 1983, at 200 kg of rice per hectare. Whenever the charge for repayment, calculated on the basis of the normal subsidy, would exceed this amount, a special arrangement to limit the charge to the ceiling amount is triggered. The arrangement may be to extend the repayment period for the loan (which implies an additional subsidy, given the below-market rate of interest on the loan), or it may be directly to increase the nominal subsidy on the capital costs, thus decreasing the amount which is to be repaid by the farmers.

With respect to price policies, the government maintains domestic rice prices significantly above world levels (Table 3.9). The government has a special account, known as the Grain Marketing Fund, which is responsible for government rice purchases and sales. Although both producer and consumer prices are maintained above world levels, the government sales price to consumers has been lower than the government purchase price plus marketing costs. As a result, the Grain Marketing Fund has incurred large deficits in its operations. These pricing policies have thus had the effect of transferring income from rice consumers and taxpayers to farmers. This additional income (or subsidy) has facilitated the payment of irrigation service fees by the farmers.

Electricity pricing policies also favor agriculture. Separate rates are charged for agriculture, industry, and household consumption. The lowest rate is for pumping water for agriculture. Because of the importance of electric pumps for irrigation, this price policy represents an indirect subsidy on the O&M costs of many irrigation projects.

[1]Several years ago the 3.5 percent rate of interest was nominally raised to 5.5 percent. According to the MAF, however, there is a special subsidy arrangement whereby the additional interest represented by the 2 percentage point increase is returned to the FLIAs. The effective cost of these loans to the FLIAs thus remains at 3.5 percent.

Table 3.9. Domestic and international rice prices ('000 won/ton of polished rice).

Rice year[a]	Government purchase price (A)	Import cost CIF (B)	Import cost adjusted to farm gate[b] (C)	Domestic/international price ratio (A/C)
1975	197	204	238	0.83
1976	244	127	163	1.50
1977	290	-	-	-
1978	328	-	-	-
1979	375	158	205	1.83
1980	458	283	355	1.29
1981	572	355	442	1.29
1982	652	267	359	1.82
1983	700	241	332	2.11
1984	700	-	-	-
1985	722	-	-	-

[a]Begins 1 November of previous calendar year and continues through 31 October of the current calendar year.

[b]Based on a 1981 net cost for transport, handling, and storage of 87,000 won/ton as reported in Kim (1982:136), adjusted for price level changes using the average producers' wholesale price index as reported in Korea Statistical Yearbook 1984 (National Bureau of Statistics 1984:403).

Sources: World Bank (1984a:Table A9. cols. 1-2) and National Bureau of Statistics (1985:76,301).

CAPITAL COSTS OF IRRIGATION

A great deal of irrigation development in Korea is a gradual process, with improvements and additions to existing facilities being made on a more or less continuous basis. Of the 103 FLIAs, a total of 65 reported expenditures in 1983 under the category of "new irrigation facilities."

The pattern of gradual development of irrigation facilities can be illustrated by information from the Kiho FLIA in Kyonggi Province. This FLIA, which covers about 14,300 ha, has 4 main reservoirs, 14 smaller reservoirs, 28 pumping stations, and 9 concrete weirs. Of the four main reservoirs and their distribution canals, three were built between 1961-1965, and one was built in 1972. The smaller reservoirs were built between 1942-1970. The pumping stations have been built over a number of years, with two constructed as recently as 1983. Many of these pumping stations, including the two constructed in 1983, do not bring new land under irrigation, but simply enhance the water supply to parts of the existing irrigated area.

Given this pattern of incremental improvement in irrigation, it is difficult to determine the capital costs of irrigation in a meaningful way. Data reported by the ADC on construction costs for eight completed agricultural development projects are given in Table 3.10. These costs, which have been adjusted to 1984 prices using the Implicit GDP Deflator, often include aspects of tidal reclamation and drainage as well as irrigation. The range of costs is from 7.4-15.4 million won/ha (US$8,950-18,620 at the 1984 exchange rate of US$1 = 827 won).

Table 3.10. Capital cost, in million won, of agricultural development projects completed by the ADC prior to 1985.

Project	Mid-point of construction period	Construction cost/ha	Cost/ha adjusted to 1984 prices[a]
Im Jin	1979	6.4	10.6
Pyongtack	1973	2.0	11.4
Kumgang	1973	1.4	7.7
Kychwado	1976	5.0	14.3
Yongsang I	1975	2.4	8.1
Nahtonggang	1981	6.4	7.3
Kyongju	1975	4.3	14.8
Changnyong	1978	7.7	15.4

[a]Based on the Implicit GDP Deflator, treating the entire cost as if it were incurred at the mid-point in the construction period.
Source: Agricultural Development Corporation (1985).

Data on farmland improvement and expansion projects completed in 1983 are presented in Table 3.11. Land consolidation averaged 5,940,000 won/ha (approximately US$7,500/ha). Drainage and slope reclamation projects were less costly, with each type amounting to about US$4,200/ha.

Table 3.11. Capital cost of farmland improvement and expansion projects completed in 1983.

Type of project	Area (ha)	Cost/ha (Million won)	Nominal subsidy as % of total cost		
			Central govt.	Local govt.	Total
Land consolidation	10030	5.94	57.1	22.9	80.0
Drainage	2737	3.32	91.7	0.0	91.7
Slopeland reclamation	694	3.34	31.2	0.6	31.8

Source: Agricultural Development Corporation (1984:Table 15).

Data on irrigation development projects completed or under construction in 1983 are shown in Table 3.12. The cost of reservoir projects completed in 1983 averaged 8.54 million won/ha (about US$10,700/ha at the 1983 exchange rate of US$1=796 won). The cost of pumping stations, weirs, infiltration galleries, and tube wells ranged from about 1.34 million won (US$1,680) per hectare (for weir projects) to 2.74 million won (US$3,440) per hectare (for pumping stations).

Tables 3.11 and 3.12 show information on the magnitude of the nominal subsidies provided by both the central and local governments for the capital costs of irrigation development and farmland improvement and expansion projects. The nominal subsidies for slopeland reclamation (a minor category involving only about 700 ha in 1983) amounted to about 32 percent. For all other types of projects, the nominal subsidies ranged from about two-thirds of the capital cost (for weirs) to over 90

percent (for tube wells and drainage projects). Local government subsidies are important for land consolidation, and for the types of structures common to small-scale irrigation projects (weirs, infiltration galleries, and tube wells).

Table 3.12. Capital cost of irrigation water development projects under construction or completed in 1983.

Type of project	Area (ha)	Cost/ha (Million won)	Nominal subsidy as % of total cost		
			Central govt.	Local govt.	Total
Reservoirs[a]	2708	8540	67.9	5.8	73.7
Pumping stations	5895	2.74	61.9	6.1	68.0
Weirs	1226	1.34	48.7	17.0	65.7
Infiltration galleries	487	1.75	61.5	20.0	81.5
Tube wells	1693	2.27	74.1	18.4	92.5

[a]Excludes data for projects not completed in 1983.
Source: Agricultural Development Corporation (1984:Table 14).

Data on the capital cost of the Im Jin Project, financed by the Asian Development Bank, are given in Table 3.13. The total capital cost of the project averaged 7,900,000 won/ha, of which 4,600,000 won was for the cost of the pumping stations. Land consolidation, undertaken on only a portion of the total area, cost 4,800,000 won/ha consolidated. The nominal government subsidy averaged 77 percent, but varied from 72 percent for the pumping stations to 100 percent for the drainage costs.

Table 3.13. Capital cost of Im Jin Project, by project component.

Item	Pumping station	Land consolidation	Conversion of upland to lowland	Drainage	Total
Area served (ha)	5736.0	3500.0	30.0	-	5803.0
Total cost (million won)	26463.0	16742.0	74.0	2528.0	45807.0
Capital cost/ha ('000 won)	4600.0	4800.0	2500.0	-	7900.0
Nominal central government subsidy (% of total cost)	72.3	81.2	75.7	100.0	77.1
Amortization payment (won/ha)	70357.0	49435.0	32067.0	-	99527.0

Source: Agricultural Development Corporation.

Data on the construction costs of five medium-scale irrigation projects financed by the World Bank are given in Table 3.14. These costs, in 1981 prices, ranged from about 4.6-6.1 million won/ha.

Table 3.14. Construction costs of five medium-scale irrigation projects.

Project district	Total cost[a] (Million won)	Benefited area (ha)	Cost/ha (Million won)
Chunseo	1820.1	258	7.1
Sewol	378.1	66	5.7
Kosan	854.1	122	7.0
Hoam	831.4	121	6.9
Samduk	657.0	123	5.3

[a]In 1984 prices. 1981 prices converted to 1984 prices using Implicit GDP Deflator (Boumphrey 1985).
Source: Kim (1982).

OPERATION AND MAINTENANCE COSTS

Budgetary Procedures for the Provision of O&M Funds

Each FLIA is responsible for the preparation of an annual budget for the O&M of its irrigation facilities. Funding of the O&M budget comes from the revenues of the FLIA, the principal component of which is irrigation service fees collected from farmers. The size of the O&M budget will thus affect the water charge which the FLIA must levy on the farmers.

Although each FLIA develops its own O&M budget, it does so within a clearly defined framework established by guidelines promulgated by the government. The guidelines for a given calendar year are distributed to the FLIA offices in October of the previous year. Each FLIA then drafts a proposed budget and forwards it to its provincial government by the end of November for approval. The provincial government in turn must send the approved budget to the FLIA by the end of December.

The Ministry of Agriculture and Fisheries provides the Ministry of Interior with general guidelines on O&M costs. The Ministry of Interior adds some more guidelines (mostly pertaining to personnel and administrative expenses) prior to sending these to the FLIAs through the provincial government offices.

In the budget guidelines a three-fold rationale for the existence of the guidelines is stated: 1) the need to decrease the costs borne by the farmer-members of the FLIAs, 2) the advantages offered by establishing an accounting system with checks and balances on revenues and expenditures, and 3) the importance of good financial management.

In estimating the revenues, the guidelines suggest that estimates should be "sound" and must be based on "reasonable assessments." The value of rice is to be based on the government purchase price of second grade rice. The FLIAs are urged to aim for increased revenues from charges for water for nonirrigation purposes, and to manage carefully their existing assets. Regarding expenditures, the

guidelines call for limiting administrative costs to the previous year's budget, for avoiding unnecessary purchase of assets and for considering the sale of existing assets which are not being used. The FLIAs are also asked to establish priorities for project expenditures.

These FLIAs are to have reserve funds both for depreciation and for retirement pensions. For depreciation, the guidelines require that depreciation, based on present book value, be maximized. Interest earnings from the depreciation fund must be added to that fund, and may not be used for other purposes. The reserve fund for retirement pensions must equal one-tenth of the monthly expenditure on staff salaries.

The guidelines for budget preparation have specific figures which set limits on many of the FLIAs' expenditures. Cost items covered by the guidelines include the following:

Standard water charges for O&M, excluding project cost repayment. A maximum water charge, specified in kilograms of rice per hectare, is stipulated for each source of water (pump, reservoir, etc.);

Personnel and labor costs. The rate per day and number of days per year are specified for each kind of labor and skill required;

Personnel allowances and benefits. Maximum meal allowances per person per day, medical insurance based on the monthly salary, clothing allowances for half of the regular staff, tuition fee allowances for the children of the staff, overtime pay during the irrigation period for the temporary staff, and salary increases for specific levels of positions are all specified in the guidelines;

Fuel costs for heating offices. Actual costs are allowed but the temperature, number of hours, and number of days for heating are specified;

Office expenses (books, magazines, newspapers, telephone, and telegram). The allowable budget depends on the size of the FLIA (e.g., number of sections, and field offices) and the number of staff members;

Allowances for officials. Allowances are stipulated for certain positions, with the amounts increasing with the size of the benefited area;

O&M of vehicles. The allowable amount per year depends on the kind of motor vehicle;

Incidental expenses. A percentage of the collection from water charges is allowed, with the percentage varying according to the size of the irrigated area.

The amounts provided for in the guidelines are maximum amounts, and it is not required that every FLIA spend at the levels indicated. A relatively poor FLIA, for example, may decide not to provide its staff members with clothing allowances, tuition fees for their children, etc.

With the allowable expenditures specified in detail in the guidelines, the FLIAs make it a point to prepare their budgets in accordance with the provisions in the guidelines. As a result, the provincial governments do not generally have to make major changes in the budget proposals submitted to them by the FLIAs.

Expenditures for O&M

Information on O&M expenditures for medium-scale, large-scale, and very large (over 20,000 ha) irrigation projects, as well as for 4 FLIAs visited by the team in September 1985 are presented in Table 3.15. The figures are expressed in terms of average amounts spent/ha of benefited area. There is little variation in the total amount among the 3 size categories of projects (ranging from 155,600-167,600 won/ha), although the 3 very large projects show a somewhat lower cost. Two of the four FLIAs visited by the team had O&M costs/ha very comparable to these averages, while one was considerably lower, and one somewhat higher.

Table 3.15. O&M expenditures by size of project, and for selected FLIAs, 1983.

Description	Benefited area (ha)	Direct O&M costs		Administrative costs		Other O&M costs		Total won/ha
		won/ha	% of total	won/ha	% of total	won/ha	% of total	
Average, all FLIAs	4321	56500	34.5	78000	47.6	29300	17.9	163800
Average, medium projects (72 FLIAs)	2036	56500	34.5	83600	51.0	23900	14.6	164000
Average, large projects (5,000-20,000 ha,[a] 28 FLIAs)	7216	59300	35.4	77700	46.4	30600	18.3	167600
Average, very large projects (over 20,000 ha, 3 FLIAs)	32139	50400	32.4	70300	45.2	34900	22.4	155600
Kiho FLIA	12450	41900	26.2	88000	55.0	30000	18.8	159900
Paju FLIA	9430	37500	32.5	53000	45.9	25000	21.6	115500
Pyongtaek FLIA	16056	73000	39.4	75800	40.9	36700	19.8	185500
Sosan FLIA	5141	38800	24.4	73700	46.3	46700	29.3	159200

[a]Based on planned development area.
Source: Agricultural Development Corporation (1984:Tables 9 and 12).

In Table 3.15, O&M costs are divided into three categories: direct, administrative, and other. Direct O&M costs include costs for repairs and operation of reservoirs, pumping stations, canals and weirs, and salaries of pumping station operators and reservoir and canal gatekeepers. Administrative costs include personnel costs other than for employees directly involved in pumping station and reservoir

and canal operation, plus office expenditures. Other costs include items such as rental of assets, dredging costs for reservoir maintenance, and forestry costs for upstream reservoir management.

In general, direct O&M costs account for about one-third of the total O&M expenditures, with little variation by project size. For the 4 FLIAs visited by the team, the direct O&M costs ranged from about one-fourth of total O&M costs in 2 cases, to nearly 40 percent in one case.

Administrative costs account for close to half of the total O&M costs of the FLIAs. There is some tendency for the absolute and relative amount of administrative costs / ha to decrease as the size of the project increases. For medium-scale irrigation projects, these costs are 51 percent of the total. For large-scale irrigation projects between 5,000-20,000 ha of planned area, the average administrative cost is about 46 percent of the total, while for the 3 largest FLIAs in the country (over 20,000 ha each), the comparable figure is 45 percent. Administrative costs in the 4 FLIAs visited ranged from 41-55 percent of total costs.

Desired Expenditures for O&M

To a considerable extent, the desired levels of expenditure for O&M, as seen by the government, are reflected in the budget guidelines prepared by the Ministry of Agriculture and Fisheries. It appears that, in general, projects do not suffer from inadequate funding for O&M. The fact that O&M expenditure levels are closely tied to the price of rice, which has not risen as rapidly as salaries and other O&M costs in recent years, has led to some financial pressures on the FLIAs. Through its budget guidelines, the government has attempted to see that these financial pressures do not lead to excessive cuts in critical O&M expenditures. For example, the government has revised downward the authorized number of personnel in various categories. The director of one FLIA indicated that staff reductions (through attrition) and reductions in use of consumable materials were the two principal methods of dealing with these financial pressures.

Control over Expenditure Decisions

Control over expenditure decisions of FLIAs is largely accomplished by the Ministry of Agriculture and Fisheries and the provincial governments through budget controls (overseeing the budget preparation through the detailed budget guidelines provided to the FLIAs, and ultimately through the power of approval of the budget) and audits of expenditures. Financially, the FLIAs are thus accountable primarily upward to the provincial government and to the Ministry. For small-scale irrigation projects run by irrigators' groups (non-FLIA), financial accountability is upward to the county (gun) executive, who has approval authority for the expenditure of the funds.

There is no formal mechanism of downward accountability that would give farmers any direct control over expenditure decisions. The degree of indirect control which the farmers have, due to the fact that the FLIAs are financially dependent on the water charges which the farmers pay, is difficult to ascertain. Wade (1982) argues that within the Korean social context, the incentives for prompt

payment and the strong coercive sanctions against defaulters largely eliminate the nonpayment of water charges as a mechanism by which farmers can register their dissatisfaction with the performance of the FLIA. On the other hand, the professional staff of the FLIA studied by Wade strongly opposed proposals from the government which would require an increase in the water charges which the FLIA would have to levy. Wade tentatively attributed this to "a diffused sense of what 'the farmers' as a body will tolerate and what they will not" (1982:132).

The government also appears to be sensitive to the levels of irrigation service fees which farmers are asked to pay. The establishment of ceilings on the O&M and project repayments components of the fees, and the fact that budgets and irrigation service fees are not finalized until the price of rice is announced each year are indications of this. In discussions at the Ministry, its efforts to reduce the O&M costs borne by farmers were noted. The Ministry is undertaking training to increase the productivity of FLIA staff, with a view to gradually reducing the number of staff employed.

FARMERS' ABILITY TO PAY FOR IRRIGATION SERVICES

Output Price Policies

As noted earlier, the price which Korean farmers receive for rice is considerably above the world price. This has a significant impact on the farmers' ability to pay the irrigation service fees. In 1983 the average fee was 156,300 won/ha; at the 1983 government price of 504 won/kg of rice, this amounts to 310 kg milled rice/ha. Based on the average 1983 yield for irrigated rice (see Table 3.18) of 6,500 kg of rice/ha (4680 kg of milled rice/ha, converted at the milling rate of 0.72), the fee amounts to 4.8 percent of gross production. At world prices, it is estimated that the farmgate price of milled rice in 1983 would have been only 332,000 won/ton of milled rice (Table 3.9), which is equivalent to 239 won/kg of unmilled rice. At this price, 654 kg of unmilled rice is required to meet the average water charge, or 10.1 percent of the average gross production.

Although it is true that if domestic rice prices were at world levels, other prices (such as wage rates) affecting the costs of production would have also been lower, it is clear that government intervention in the rice market in Korea has a significant effect on the ability of the Korean farmers to pay for the costs of irrigation services.

Price Policies for Inputs other than Water

As noted, farmers in Korea have had to pay somewhat more for fertilizer than would be the case if world prices prevailed. This has had a modest negative impact on their ability to pay for irrigation services.

Of greater importance than fertilizer price policies are the policies for the pricing of electricity. Of the various categories of electricity rates, the lowest applies to power used for irrigation. This rate is only 20.35 won/kilowatt hour (kwh), compared with the lowest of several rates for industrial users of 46.85 won/kwh. Given the large amount of pumping for irrigation in many projects, this subsidy can have a significant impact on the costs which farmers must pay.

Data from the Pyongtaek FLIA provide an example of the importance of this subsidy. Six large electrically driven surface pumps provide a substantial amount of the irrigation water used. During the 1985 irrigation season, a total of 18,637,000 kwh of electricity was used. At the agricultural price of electricity of 20.35 won/kwh, this amounts to 379,262,950 won or about 24,000 won/ha of assessed area. If the industrial rate of 46.85 won/kwh had applied, the electricity charge would have been approximately 2.3 times as much or 55,200 won/ha. The subsidized electricity rate thus reduces the water charge that must be paid by the farmers served by the Pyongtaek Project by an average of about 31,200 won/ha, which is about 15 percent of the average irrigation service fee assessed in the Pyongtaek FLIA (see Table 3.28).

Tax Policies

The ability of the farmer to pay for irrigation services may also be affected by the policies of the government with respect to taxes which must be paid by farmers. In Korea, there are no significant taxes paid by farmers to the central government; the farmers, however, pay two land-related taxes to county or city governments.

Property tax. Owners of all kinds of land are required to pay a property tax at the rate of 0.1 percent applied to the taxable value of the land. The taxable value of the land depends on the grade into which it is classified, which in turn is related to market values. Data on the actual amounts of these taxes paid by owners of agricultural land are not available; most farmland not located close to urban centers, however, is classified in grades that lead to taxable values of 6-14 million won/ha, which implies a typical tax burden of 6,000-14,000 won/ha. This represents 4 and 9 percent of the average irrigation service fee assessed of 156,300 won/ha (see Table 3.28).

Farmland tax. In addition to the property tax, a farmland tax must be paid by owners registered in the farmland tax book. Taxes are based on the income derived from the farmland, minus a fixed exemption of 1.44 million won/household. Taxable income is subject to taxation at progressive marginal rates ranging from 6-55 percent (Table 3.16).

In the absence of the detailed farm records needed for the calculation of the taxable income, a farmer may elect to have the taxable income based on standard yield and expenditure figures. For rice, the standard yield depends on the class of farmland, and is converted to value terms at the government price of rice. Deductible production expenses include all direct production expenses, excluding the value of family labor. It has been suggested that the use of standard yield and expense figures results in taxable incomes which are low relative to actual cash incomes (Harris 1979:348).

The absence of data on tax collections makes it difficult to assess the importance of the tax for other farmers. To gain some insight into the matter, estimates of the average amount of farmland taxes that would be due from rice farming have been developed (Table 3.17). These figures are based on an annual survey of costs and returns to rice production conducted by the Ministry of Agriculture and Fisheries. The costs which are deducted from gross receipts are the average management expendi-

Table 3.16. Farmland tax rates, 1985.

Level	Income subject to tax[a]	Corresponding land tax (in won)
1	< 1.8	Amount x 6%
2	< 1.8 to 2.5	108000+ amount in excess of 1.8 million won x 8%
3	< 2.5 to 3.5	164000+ amount in excess of 2.5 million won x 10%
4	< 3.5 to 4.8	264000+ amount in excess of 3.5 million won x 12%
5	< 4.8 to 6.3	420000+ amount in excess of 4.8 million won x 15%
6	< 6.3 to 8.0	645000+ amount in excess of 6.3 million won x 18%
7	< 8.0 to 10.0	951000+ amount in excess of 8.0 million won x 21%
8	< 10.0 to 12.5	1371000+ amount in excess of 10.0 million won x 24%
9	< 12.5 to 15.5	1971000+ amount in excess of 12.5 million won x 27%
10	< 15.5 to 19.0	2781000+ amount in excess of 15.5 million won x 31%
11	< 19.0 to 23.0	3866000+ amount in excess of 19.0 million won x 35%
12	< 23.0 to 29.0	5266000+ amount in excess of 23.0 million won x 39%
13	< 29.0 to 37.0	7606000+ amount in excess of 29.0 million won x 43%
14	< 37.0 to 47.0	11046000+ amount in excess of 37.0 million won x 47%
15	< 47.0 to 60.0	15746000+ amount in excess of 47.0 million won x 51%
16	60.0 and above	22376000+ amount in excess of 60.0 million won x 55%

[a]In million won. Income subject to tax is the farmer's income (p Total revenue from production — deductible production expenses), minus the tax exemption of 1.44 million won.
Source: Gyong Gi Province, Republic of Korea (1984).

tures; these are similar to expenses which are deductible under the farmland tax. For farms under 1.0 ha in size — which comprise about two-thirds of all farm households in Korea (Table 3.5) — little or no tax would be due. This is consistent with reports that since 1984, about 55 percent of Korean farmers pay no farmland tax. For farmers with 1.0-1.5 ha (about 20 percent of the farm households), the tax is estimated to average about 20,000 won/ha. This is about 13 percent of the average assessment for irrigation service fees.

Table 3.17. Estimates of the importance of farmland taxes on rice land by size of farm, 1984.

Farm size (ha)	Average gross receipts ('000 won/ household)	Average management expenditure ('000 won/ household)	Average net income ('000 won/ household)	Average taxable income[a] ('000 won/ household)	Farmland tax ('000 won/ household)	Farmland tax ('000 won/ ha)[b]
< 0.5	2260	938	1322	0	0	0.0
0.5 - 1.0	2124	665	1459	19	1	1.3
1.0 - 1.5	2805	870	1935	495	30	20.0
1.5 - 2.0	3301	912	2388	948	57	32.6
> 2.0	5075	1510	3565	2125	134	< 67.0

[a]Equals net income minus the basic farmland tax exemption of 1.44 million won.
b Based on the mid-point of the farm size category.
Source: Ministry of Agriculture and Fisheries (1985:318).

Nature and Magnitude of Direct Irrigation Benefits

The benefits of irrigation to Korean farmers consist mainly of increased yields due to reduced water stress and to earlier transplanting and savings in labor associated with water and weed control. Some changes in cropping intensities may occur as a result of irrigation, but the direction of the change is not consistent. The conversion of upland rice to lowland rice is frequently associated with a decrease in the cropping intensity. This is because upland crops are frequently of short duration, so that the cropping intensity is often greater than 1.0, while only a single rice crop is grown on much of the rice land. On the other hand, cropping intensities have been observed to increase in some cases where existing rice land is brought under irrigation. In these cases, farmers with irrigated rice planted a winter barley crop following the summer rice crop, while farmers with unirrigated rice did not grow barley because it interfered with timely transplanting of the rice crop (Kim 1982).

There are few data that provide direct evidence of the effects of irrigation on rice yields. From the indirect information that is available, two conflicting pictures emerge: one suggesting large increases in yield due to irrigation, and the other suggesting very modest increases in yield.

Studies which appraise or evaluate specific irrigation projects frequently anticipate or report large increases in rice yields as a result of irrigation. For example, the appraisal report for the Pyongtaek-Kumgang Irrigation Project estimated that yields would double as a result of irrigation. This was based on the reported average yield of rain-fed rice of 2.0 tons of polished rice/ha in normal years, and a reported average yield of over 4.0 tons/ha achieved by each of a small number of FLIAs (then called Land Improvement Associations) accounting for 4 percent of the irrigated area of the country (World Bank 1969). Similarly, for the Im Jin Project (operated by the Paju FLIA) financed by the Asian Development Bank, rice yields were projected to rise from 3.2 to 5.3 tons/ha by 1988 as a result of the project (Ahmad, Perez, and Kanamori 1983:83).

Some postproject evaluations have also reported large increases in yields as a result of irrigation. In an evaluation of the results of a United States Agency for International Development (USAID) loan-financed report of some 66 small-scale irrigation projects, it was noted that the average increase in yields in 14 projects visited was 2.4 metric tons of polished rice/ha, with increases in the individual projects ranging from 1.5-3.6 tons (Steinberg et al. 1980:4). These figures, however, represent the change in yields between 1974 and 1979 as reported by farmers when questioned by the evaluation team. No attempt was made to assess the reliability of these estimates, or to separate the effect of irrigation from other factors affecting yields. An evaluation of the results of several medium-scale irrigation projects financed under a World Bank loan reported increases in rice yields ranging from 1.0-1.3 tons of polished rice/ha, with the average increase being 1.1 tons (Kim 1982:48). Again, however, the increase (which the report attributes entirely to irrigation) is simply the difference in yields before and after the project.

Aggregate data published by the Ministry of Agriculture and Fisheries provide an alternative approach to evaluating the effect of irrigation on yield. Yield data for rice in irrigated areas managed by the FLIA can be compared with average yield data for all rice. This comparison is presented for the years 1979-1984 in Table 3.18. No yield data on the small-scale irrigation projects of less than 50 ha

(managed by the irrigators' groups) are available. It was thus assumed in making the calculations for Table 3.18 that the average yield in the areas served by the irrigators' groups was the same as in the areas served by the FLIAs. This assumption probably overstates the yields of the small-scale irrigation projects. Oh (1978), who surveyed 64 small reservoir systems, concluded that most of them had failed to get the water to the farmers in the right amounts and at the right times. He also noted that the physical maintenance of these systems was poor.

The implied differences between the average yields of irrigated and non-irrigated rice are in the final column of Table 3.18. To the extent that the yield of irrigated rice in areas served by the small-scale irrigation projects is overestimated, the figures in this column are also overestimated. As would be expected, the differences vary considerably among years, presumably reflecting differences in weather conditions. The smallest difference was 0.21 tons/ha in 1984, while the largest was 2.41 tons/ha in 1980. The average difference over the 6 years was 1.08 tons of polished rice/ha.

Table 3.18. Average irrigated and nonirrigated[a] rice yields,[b] 1979-1983.

Year	Irrigated rice (ha)	Irrigated rice as % of total rice area	Reported yields[b]		Implied yield of non-irrigated rice[d]	Implied average difference in yield between irrigated and nonirrigated rice
			Irrigated rice[c]	All rice		
1979	866682	66	4.65	4.53	4.30	0.35
1980	893359	68	3.66	2.89	1.25	2.41
1981	908058	69	4.56	4.16	3.27	1.29
1982	916956	70	4.77	4.38	3.47	1.30
1983	928546	71	4.69	4.42	3.76	0.93
1984	934770	71	4.68	4.62	4.47	0.21
Average		69	4.50	4.17	3.42	1.08

[a]In Korean statistics, all rice fields are considered to be either "irrigated" or "partially irrigated." The term nonirrigated as used in this table refers to the data on "partially irrigated" rice fields.

[b]All yield figures are in metric tons of polished rice/ha.

[c]Based on data for FLIAs.

[d]Assumes average irrigated yield in non-FLIA areas (irrigation groups) is the same as in the FLIA areas.

Sources: Agricultural Development Corporation (1985:17, 545); Nationnal Agricultural Cooperative Federation (1984: Statistical Table 10); and National Bureau of Statistics (1984:124).

Part of the reason for the relatively small difference between the average yields of irrigated and nonirrigated rice may be that the nonirrigated rice is not completely dependent on rainfall. Korean statistics report all rice not irrigated by FLIAs or irrigators' groups to be "partially irrigated." But all irrigation projects which irrigate existing rice fields are limited to improving conditions over the pre-existing "partially irrigated" conditions. The aggregate statistics thus suggest that the average

increase in rice yields due to irrigation may be considerably less than has been indicated in reports of specific projects.

Another indirect method of estimating the benefits of irrigation is to examine data on the increase in land values resulting from the implementation of irrigation projects. In his evaluation of medium-scale irrigation projects funded by the World Bank, Kim (1982) obtained data on land values in the area irrigated by the projects, and in nearby nonirrigated areas. The increases in land values that could thus be attributed to irrigation were much smaller than would be expected from his estimates of the increases in net farm income.

Calculations based on Kim's data are presented in Table 3.19. The last line of Estimate 1 presents Kim's estimates of the increase in net income due to irrigation. These range from 663,000-819,000 won/ha. Also shown in the table are the major components underlying the estimated increase in net income.

Table 3.19. Estimated effect of irrigation on net income from production of high-yielding varieties of rice in five medium-scale irrigation projects, 1982.

	District in which project is located				
	Chunseo	Sewol	Kosan	Hoam	Samduk
Estimate 1: Based on reported increase in yields.					
Reported increase in yield (kg/ha)[a]	1300	1045	1140	1158	1100
Value of increased yield ('000 won/ha)[b]	848	681	743	755	717
Reduction in labor cost ('000 won/ha)[c]	74	74	74	74	74
Increased cost of fertilizer ('000 won/ha)	14	25	15	23	23
Other increased production costs ('000 won/ha)	89	44	81	87	105
Increase in net income ('000 won/ha)	819	666	721	719	663
Estimate 2: Based on reported increases in land values due to irrigation.					
Value of high-class land, irrigated ('000 won/ha)	12200	11041	12403	17805	13815
Value of high-class land, nonirrigated ('000 won/ha)	10346	10134	11093	15246	10285
Increase in land value due to irrigation ('000 won/ha)	1854	907	1310	2559	3530
Implied increase in net income at 20% capitalization rate ('000 won/ha)	371	181	262	512	706
Implied yield increase due to irrigation (kg/ha)[d]	613	270	436	840	1166
Yield increase due to irrigation as % of total yield increasee	47	26	38	73	106

[a]Polished rice.

[b]Based on the 1982 government price of 652 won/kg.

[c]Average for the 5 projects of approximately 10 man-days/ha.

[d]Assuming the same changes in production costs as in Estimate 1.

[e]Total yield increase is given in Estimate 1.

Source: Kim (1982).

The most important component is the value of the increase in rice yield. But an additional source of increased income is a modest but significant saving in labor costs. Kim reports in some detail on differences in labor use for various crop production activities before and after irrigation. The most important differences directly attributable to irrigation appear to be a decrease of about 16 man-days/ha for irrigation and drainage activities, and an increase of about 6 man-days/ha for harvesting activities. The decrease in labor for irrigation activities reflects the fact that in the absence of the irrigation project, farmers were engaged in a variety of water control efforts. Thus the net labor saving due to irrigation was about 10 man-days, equivalent to about 74,000 won/ha.

Additional fertilizer use following the introduction of irrigation increased the cost of production modestly. The residual category "other increased production costs" in Table 3.19 (Estimate 1) includes changes in a variety of items such as pesticides, seeds, machinery, etc.

Kim's data on land prices permit an alternative estimate of the increase in net income from these irrigation projects (Table 3.19: Estimate 1). Data for the best class of land indicate increases in land values of from 907,000-3,530,000 won/ha due to irrigation. To translate these increases into estimates of increases in annual net income requires the choice of a capitalization rate. The lower the rate chosen, the lower will be the estimated increase in net income. A relatively high rate of 20 percent was used in the calculations in Estimate 2 of Table 3.19. At this rate, the estimated increase in net income due to irrigation ranges from 181,000-706,000 won/ha. Using the same figures as presented in Estimate 1 (Table 3.19) for the changes in cost of production (for labor, fertilizer, and "other"), the yield increase consistent with these estimates of increased net income can be calculated.

In the final line of Estimate 2 (Table 3.19), these implied yield increases due to irrigation are compared with the reported total increase in yield used in calculating the original estimates of the effect of irrigation. For the projects in Chunseo, Sewol, and Kosan districts, the implication is that the increase in yield due to irrigation is only from one-fourth to one-half of the reported total increase in yield. For projects in the Hoam and Samduk districts, the implied yield increase due to irrigation is much closer to the total increase.

It is likely that part of the reason for the difference between the two latter districts and the first three districts was that in Hoam and Samduk districts, barley was grown following rice on about one-fifth of the area (giving a cropping intensity of 1.2), whereas in the other districts, barley was not grown, and the cropping intensities were about 1.0. The additional income earned from barley production should account for part of the increase in land values in these two districts, and should not be attributed to rice, as it is in Estimate 2 (Table 3.19).

Estimates of Farmers' Ability to Pay for Irrigation Services

Farmers' ability to pay for irrigation services can be considered from at least two points of view: the cost of irrigation services relative to the income generated from irrigated crop production, and the cost of these services relative to the incremental income attributable to the irrigation services. While the second approach is more satisfactory from a conceptual point of view, the data requirements for the first are much less demanding.

Estimates of the cost of irrigation services relative to income for various projects are presented in Tables 3.20 and 3.21. Estimates for the Im Jin and Pyongtaek-Kumgang projects are based on income projections made either at the time of project appraisal, or shortly after the project was completed. In the case of Im Jin, the projections imply a ratio of water charges to the incremental net income due to irrigation (the benefit recovery ratio) of 11.7 percent for a composite farm with a cropping pattern which mirrors the anticipated aggregate cropping pattern. For a farm producing only rice, however, the data imply an average benefit recovery ratio of 20.9 percent. This considerably higher benefit recovery ratio is particularly relevant in light of the fact that at the time of the Asian Development Bank Project Completion Report, the target for irrigated rice for the project had increased by 24 percent over the amount anticipated at the time of appraisal (Ahmad, Perez, and Kanamori 1983:24).

Table 3.20. Estimates of proportion of increases in income needed to pay irrigation service fees for several projects with international financing.

Project and basis for estimate	Water charges as percentage of:			
	Total gross income	Incremental gross income	Total net income	Incremental net income
1. Im Jin (projections)				
a. Average, all sources of increased agricultural income	n.a.	n.a.	6.7	13.0
b. Average, composite farm	4.6	9.3	6.4	11.7
c. Average, rice farm	6.7	16.8	9.3	20.9
2. Pyongtaek-Kumgang (projections)				
a. Average, farm with rice-barley rotation	13.9	25.8	25.4	32.7
3. Average, 15 small-scale projects (*ex post* evaluation)	n.a.	11.6	n.a.	n.a.

n.a. = not available.

Sources: Ahmad, Perez, and Kanamori (1983), World Bank (1969), and Steinberg et al. (1980).

Similar estimates were derived from projections in the World Bank's appraisal report for the Pyongtaek-Kumgang Project. These estimates suggest that on average, approximately one-third of the net benefits would be needed to meet the water charges imposed. In part, this high benefit recovery ratio results from the high cost of the project, with the resulting high level of irrigation service fees. Fees in the Pyongtaek FLIA are 29 percent higher than the national average (see Table 3.28).

The postproject evaluation of small-scale irrigation projects financed with a loan from USAID did not provide enough data to determine benefit recovery ratios. For the 14 projects surveyed, however, the average water charges amounted to 11.6 percent of the incremental gross income. If the relationship between this ratio and the benefit recovery ratio is similar to the situation with the Im Jin and Pyongtaek-Kumgang projects, as shown in Table 3.20, then the average benefit recovery ratio for these projects would be 14-17 percent.

Table 3.21. Estimates of benefit recovery ratios for farmers growing modern rice varieties in five medium-scale irrigation projects.

	District in which project is located				
	Chunseo	Sewol	Kosan	Hoam	Samduk
Estimate 1: Based on reported total increase in yields.					
Incremental net income/ha, 1982 ('000 won)	819	666	721	719	663
Incremental net income/ha, adjusted to 1983 prices ('000 won)	880	715	774	772	712
Average water charges, 1983 ('000 won/ha)	196	196	146	166	136
Benefit recovery ratio (%)	22	27	19	22	19
Estimate 2: Based on increase in land values.					
Incremental net income/ha, 1982 ('000 won)	371	181	262	512	706
Incremental net income/ha, adjusted to 1983 prices ('000 won)	398	194	281	549	757
Average water charges, 1983 ('000 won/ha)	196	196	146	166	136
Benefit recovery ratio (%)	49	101	52	30	18

Sources: Calculated from Table 3.19 and Kim (1982).

Two alternative estimates of the benefit recovery ratios for each of the five medium-scale irrigation projects studied by Kim (1982) are presented in Table 3.21. The first estimate is based on the total reported increase in yields, while the second is based on data on increases in land values. The first method gives benefit recovery ratios ranging from 19-27 percent. The second method gives a wider range of values for the five projects. For 2 of the projects, the estimated benefit recovery ratios are approximately 50 percent, while in one case, the ratio is about 100 percent. For the 2 projects with cropping intensities significantly greater than 1.0 (Hoam and Samduk), and which thus may have had higher net benefits than the other projects, where a single rice crop dominated the cropping pattern, the benefit recovery ratios are estimated to be 30 and 18 percent, respectively.

The aggregate data on irrigated and nonirrigated yields for the years 1979-1984 provide the possibility of estimating the average water charges as a percentage of the difference in gross income between the irrigated and nonirrigated rice (Table 3.22). Conceptually, these estimates are roughly comparable to those in the second column of Table 3.20. But because they ignore the effect of irrigation on crops other than rice, while including total charges for irrigation water, they overestimate the proportion of actual benefits which is used to pay for water charges.

The estimates in Table 3.22 indicate that over the 6-year period, the average proportion of the gross incremental rice production needed to pay water charges ranged from 11-107 percent. The average for the 6-year period was 43 percent. Assuming that the relationship between this ratio and the benefit recovery ratio is approximately the same as observed for the Im Jin and Pyongtaek-Kumgang projects in Table 3.20, the implied average benefit recovery ratio for the 6-year period would be about 54 percent.

Table 3.22. Estimates of average irrigation service fees and average increases in gross income, 1979-1984.

Year	Average increase in gross income[a] ('000 won/ha)	Average irrigation service fee[b] ('000 won/ha)	Irrigation service fee as % of increase in gross income
1979	131	100	76
1980	1104	118	11
1981	738	145	20
1982	848	152	18
1983	651	156	24
1984	147	158	107
Average	603	138	43

Sources: [a]Calculated from Tables 3.9 and 3.18; [b]Agricultural Development Corporation (1985:546).

Implications of Alternative Policies

To gain additional insights regarding questions of the farmers' ability to pay for irrigation services under alternative financing policies, we have developed a series of tables to compare the income earned from irrigated agriculture relative to some minimally acceptable reference income level. The data are expressed in terms of the equivalent amount of rice.

Rough estimates of average costs and returns to irrigated rice production in Korea for 1983 are presented in Table 3.23. These are based on the estimated average yield of irrigated rice, average water charges for irrigation, and average costs of production for rice as estimated by the Ministry of Agriculture and Fisheries on the basis of its annual Production Cost Survey of Agricultural Products. The returns shown 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.

Using these cost of production figures from Table 3.24, hypothetical average returns that might be earned under alternative policies regarding rice prices and water charges are presented in Table 3.23. For rice price policy, the assumed change is to allow prices to drop to levels consistent with world prices by permitting free entry of imports. This price level for 1983 was estimated at 239 won/kg rice, compared to the actual government price of 504 won/kg (equivalent to 700 won/kg of milled rice, as given in Table 3.9). In the case of the policy for water charges, the assumed change is to require farmers to pay for the full cost of irrigation (both O&M and capital investment). Two different levels of investment costs are considered: a moderate level of 5 million won/ha, and a high level of 9 million won/ha. These levels are consistent with the investments that have been made in the Republic of Korea in the recent past (Tables 3.10-3.14).

To place the net return figures in Tables 3.23 and 3.24 in perspective, two reference levels of income have been calculated (Table 3.25). The first reference level is what we have termed "parity household

Table 3.23. Hypothetical average costs and returns to irrigated rice production, 1983, assuming changes in policies regarding rice prices and water charges (kg rice/ha).

Item	Assumed policy conditions				
	World rice prices[a] with actual water charges	Actual rice prices with water charge raised to 100% cost recovery, assuming:		World rice prices[b] with water charges raised to 100% cost recovery, assuming:	
		moderate investment cost[b]	high investment cost[c]	moderate investment cost[b]	high investment cost[c]
Gross receipts	6500	6500	6500	6500	6500
Water charges for O&M	506	334[d]	334[d]	704[d]	704[d]
for capital repayment	148	1476	2285	3112	4819
in-kind labor contributions	(48)	(23)	(23)	(48)	(48)
Other purchased current inputs, excluding labor	1488	706	706	1488	1488
Hired labor	751	356	356	751	751
Returns to family-owned resources[e]	3607	3628	2819	445	-1262

[a]Korean rice price assumed to drop to 239 won/kg (332 won/kg milled rice) with no restriction on imports (based on Table 3.9).

[b]Assumed to be 5,000,000 won/ha, which is equivalent to an annualized value of 743,800 won/ha (based on Table 3.29).

[c]Assumed to be 9,000,000 won/ha, which is equivalent to an annualized value of 1,151,840 won/ha (based on Table 3.29).

[d]Based on average actual cost of O&M of 168,200 won/ha (Table 3.28).

[e]If family owns all land farmed.

agricultural income" expressed on a per hectare basis (line 9 of Table 3.25). "Parity" income represents a level of per capita income which is comparable to the average per capita income for the Republic. Given that agricultural income represents only about 65 percent of total farm household income, the parity level of household agricultural income is taken as 65 percent of the parity level of total household income. The average size of farm is used to convert the parity level of agricultural income from a per household to a per hectare basis. The second reference income level is an estimated absolute poverty level of income. The estimated per capita absolute poverty level for rural areas in 1978 (World Bank 1984a) was first adjusted to 1983 prices, and then converted to a per hectare basis in the same manner as for the "parity" income.

Table 3.24. Approximate average costs and returns to irrigated rice production in the Republic of Korea, 1983.

	Amount		% of value of total production
	('000 won/ha)	kg rice[a]/ha	
Gross receipts[b]	3276.0	6500	100.0
Water charges[c] for O&M	121.0	240	3.7
for capital repayment	35.3	70	1.1
in-kind labor contribution	(11.4)[d]	(23)[d]	(0.4)[d]
Other purchased current inputs, excluding labor[e]	355.7	706	10.9
Hired labor[f]	179.4	356	5.5
Returns to family-owned resources (if family owns all land farmed)	2584.6	5128	78.9

[a]Unmilled rice.

[b]Based on average irrigated yield of 6.5 tons rice (4.69 tons milled rice)/ha — Table 3.18 and the 1983 government price for Grade B rice of 504 won/kg.

[c]Separation of O&M from capital repayment in the average water charge from Agricultural Development Corporation data. In-kind contribution estimated at 2 man-days of labor from discussions with officials in selected FLIAs. Average wage rate of 5,700 won/day based on 1980 data (World Bank 1984 a:139), adjusted to 1983 using the Consumer Price Index (National Bureau of Statistics 1985:203).

[d]Noncash item.

[e]Calculated from the Ministry of Agriculture and Fisheries (1985:296-299).

[f]Ministry of Agriculture and Fisheries (1985:299).

Table 3.25. Calculation of income reference levels, Republic of Korea, 1983.

	Item		Amount
1.	Average farm household income (won)[a]	..	5128244.0
2.	Average farm household size (persons)[b]	..	5.0
3.	Average per capita income of farm household (1-2)	...	1025649.0
4.	Average per capita income, Republic of Korea[c] (won)	..	1128204.0
5.	"Parity" farm household income (won) (2x4)	..	5641020.0
6.	Household agricultural income as % of average farm household income[d]	..	65.0
7.	"Parity" household Agricultural income (won) (5x6)		3666663.0
8.	Average farm size[e] (ha)	..	1.1
9.	"Parity" household agricultural income per hectare (won) (7 - 8)	..	3333000.0
10.	Estimated per capita absolute poverty income level (rural) (won)[f]	..	252000.0
11.	Estimated farm household absolute poverty level (won) (2x10)	..	1260000.0
12.	Estimated poverty level of agricultural income per household (11x6)	..	819000.0
13.	Estimated poverty level of agricultural income per hectare (12 - 8)	..	744545.0

Sources: [a]National Agricultural Cooperative Federation (1984:84); [b]National Agricultural Cooperative Federation (1984:82); [c]National Bureau of Statistics (1984:451); [d]National Agricultural Cooperative Federation (1984:84); [e]National Agricultural Cooperative Federation (1984:81); [f]1978 estimate of US$270 taken from World Bank Social Indicator Data Sheets (World Bank 1984a) and converted to 130,680 won at the 1978 exchange rate of 484 won/dollar. Using the Implicit GDP Deflator, this was converted to 252,000 won at 1983 prices.

In Table 3.26, these two reference levels of income are converted into kilograms of rice per hectare at the 2 alternative price levels considered (actual 1983 price of 504 won/kg and estimated 1983 price consistent with world prices of 239 won/kg). The returns to family owned resources (from Tables 3.23 and 3.24) are again presented, and then compared to the two reference income levels.

Table 3.26. Estimated effects of alternative rice price and water charge policies on farm returns relative to reference income levels, 1983.

Item	Assumed policy conditions					
	Actual prices and water charges	World prices and actual water charges	Actual prices with water charge raised to 100% cost recovery, assuming:		World prices with water charge raised to 100% cost recovery, assuming	
			moderate investment cost	high investment cost	moderate investment cost	high investment cost
Reference income levels						
(kg rice)[a] "Parity" household agricultural income per hectare	6613.0	13946.0	6613.0	6613.0	13946.0	13946.0
"Poverty" household agricultural income per hectare	1477.0	3400.0	1477.0	1477.0	3400.0	3400.0
Farm returns (kg rice/ha)[b]						
Returns to family resources if all land is owned)	5128.0	3607.0	3628.0	2819.0	445.0	-1262.0
Farm returns relative to "Parity" (%)						
Returns to family resources (if all land is owned)	77.5	25.9	54.9	42.6	3.2	-
Farm returns relative to "poverty" (%)						
Returns to family resources (if all land is owned)	347.0	106.0	246.0	191.0	13.0	-

Sources: [a]Calculated from Table 3.5; [b]calculated from Tables 3.3 and 3.4.

Based on the actual rice price and on policies regarding irrigation service fees, returns to family resources are estimated to be about 78 percent of the "parity" level as defined above, and nearly 3.5 times the poverty level. Reducing prices to world levels lowers the parity ratio to about 26 percent, and brings returns down to only 6 percent above the poverty level. Maintaining Korean prices at their actual level, but requiring full recovery of all costs in the situation of high investment costs (9 million won/ha) results in a lowering of both ratios to about 55 percent of their current levels. Combining the two policies implies very low (much below the poverty level) or negative returns.

It is clear that farmers would not have the ability to pay for the full cost of irrigation services if import controls on rice were removed so that Korean rice prices would be consistent with world market conditions. Even at current rice prices, raising water charges to a level necessary to cover the full cost of irrigation services would create substantial reductions in farm incomes. Finally, if world prices were to prevail, current levels of payments for irrigation services would be extremely burdensome. Returns to family resources of about 3,600 kg of rice per hectare would be only slightly above the poverty level, while cash payments for irrigation service fees would amount to over 650 kg of rice per hectare. Payments for water would thus equal about 18 percent of the value of the returns to family resources.

DIRECT METHODS OF FINANCING IRRIGATION SERVICES

Policy Principles

One important policy principle underlying the financing of irrigation services is that within the framework of prices established by government policy, and within the framework of rules regarding 1) central and local government subsidies for irrigation services and 2) central and local government controls over budget preparation and expenditures, the FLIAs must be financially autonomous. This implies both that each FLIA must generate revenues through charges it imposes on its members, and that other revenues which the FLIA can generate from its assets can be retained to help cover its expenditures.

A second implied policy principle is that water charges should be related both to the benefits received and to the cost of the services provided. This principle leads to differences, even within a single FLIA, in water charges among farmers.

Financing Mechanisms

The primary mechanism of direct financing of irrigation services is per hectare charges levied on farmers in irrigated areas. These irrigation service fees are used in areas irrigated by both FLIAs and irrigators' groups. A second important financing mechanism is secondary income which the FLIAs generate from assets which they control. This includes interest income, income from the sale of water for nonagricultural purposes, and revenues from the sale of assets.

Assessment, Billing, and Collection Procedures

Assessment. Determination of the water charges to be assessed to each farmer served by an FLIA is a fairly complex process, the details of which vary among FLIAs. As a general rule, each FLIA consists of several districts, or project units, each of which may be served by relatively independent irrigation facilities.[2] There is a total of 932 such districts in the existing 103 FLIAs. Within a single FLIA, certain components of the water charges vary by district.

[2]The existing 103 FLIAs are the result of a number of mergers of smaller FLIAs over the years. In 1969, for example, there were 272 associations (World Bank 1969). The mergers reflected government policy designed to enhance administrative efficiency. Some of the districts of existing FLIAs were originally independent FLIAs.

Information obtained from the Paju FLIA illustrates the assessment procedures. Paju consists of five districts or subprojects. The O&M component of the water charge varies among the five districts, but is uniform within each of the districts.[3] In calculating the O&M component of the water charge, a distinction is made between administrative costs and the direct cost of irrigation (pumping, operation of reservoir and canal gates, etc.). A single average per hectare cost of administration is calculated and applied to all land in all districts. The direct costs of irrigation are calculated separately for each district.

With respect to the component of the water charge for the repayment of the project construction costs, four grades of land are recognized, based on the presumed benefits received as a result of the irrigation project. The highest charge is levied on land which is newly irrigated by the project, and on which land consolidation has taken place. Newly irrigated land not yet consolidated is charged a lower amount. Previously irrigated land which has been consolidated is charged a still lower amount, while the lowest charge is levied against previously irrigated land which has not been consolidated.

The Pyongtaek FLIA has a slightly different way of applying the same basic benefit principle. Unlike most FLIAs, Pyongtaek consists of a single zone. Thus the component of the water charge covering O&M is uniform throughout the area served. The component of the charge for the repayment of project costs varies according to three factors. A basic charge for capital repayment (currently 50 kg rice/ha) is levied against all irrigated land. Additional charges are levied against sloped land (70 kg/ha) and against land which has been consolidated (60 kg/ha).

Billing. Bills for each farmer are prepared by the FLIA. In some cases, as with the Pyongtaek FLIA, the actual bill is generated by a computer operated by the provincial government, for which service the FLIA pays the provincial government. The bills may be given to a farmer representative (*Hueng Nong Gye* leader) from each village; in order to speed delivery of the bills to the farmers (and thus to enhance the prospects for early receipt of the charges), however, the FLIA field staff may deliver the bills to the individual farmers. In the case of a few, relatively isolated farmers, the bills may be mailed.

As a rule, the bill is delivered to the farmer on or before 25 November. The bill contains the farmer's name, his address, the amount due if it is paid on or before 25 December, and the amount to be paid should the water charge be paid after the due date. Penalty charges apply to late payments. The bill shows only the water charge to be paid and has no indication of the area or type of crop served by the irrigation system.

Collection. Since 1984, all irrigation service fees are paid by the farmers in cash to the FLIA through the county and subcounty ("unit county") cooperatives of the National Agricultural Cooperative Federation. It is the policy of the Ministry of Agriculture and Fisheries that all matters pertaining to collections of money from farmers must be handled solely through the National Agricultural Cooperative Federation. Four reasons are given for this policy:

a) Adding the collection of water charges to the Federation's activities increases the use of the local cooperatives which are fairly accessible to the farmers;

[3]This represents a considerable simplification over the procedure that was used until 1984. Under the previous approach, O&M charges were differentiated according to some 20 different categories of land.

b) it is considered to be less costly for the Federation to collect the water charges than for the Ministry and the FLIAs to provide the needed staff members at the office and field stations for the same purpose;

c) direct payment by farmers to the Federation prevents problems which may arise from the handling of cash by the FLIA staff, especially if the collections are not remitted to the local bank at the end of each day; and

d) the collection methods are the same as what exist for the collection of government taxes.

Every year, the local FLIA signs an agreement with the county cooperative authorizing it to receive, for the special account of the FLIA, the payments of farmers for water charges. It notifies its subcounty cooperatives of the agreement, and authorizes them to receive the payments of farmers to be credited to the account of the FLIA. The farmer may pay his bill at the county cooperative designated by the FLIA as its collector or at any of the cooperative's subcounty offices.

The county or subcounty office issues the farmer a receipt upon payment. A copy of the receipt is forwarded within one day to the FLIA for its record. The subcounty cooperative may keep the payments received from farmers for a maximum of only two days prior to forwarding the amount to the county cooperative which in turn keeps the pooled collections as a deposit of the FLIA until the amount is used or withdrawn by the FLIA. Any payment the FLIA has to make to the Ministry of Finance is made through the issuance of a check debited against the account of the FLIA.

The county and subcounty cooperatives receive no commission, nor do they charge any service fee for the collection of water charges for the FLIA. They benefit, however, in the following ways:

a) A farmer who pays his water charges at the county cooperative after the harvest season is most likely to deposit his other cash also in the same cooperative, thus giving it an added volume of business.

b) In the process of going to this cooperative to make his payment, the farmer may also purchase materials for home use from the cooperative store, which in most cases is housed in the same building.

c) The farmer may be more likely to pay his other taxes (e.g., property tax for land and house) through this cooperative, which would benefit from these transactions because the money can be kept on deposit for a period of time at the cooperative.

Furthermore, there is a keen business competition between the commercial banks and the National Agricultural Cooperative Federation cooperatives. The county cooperatives consider the service to FLIA farmers as a source of goodwill. In most cases, the farmers paying their water charges are also members of the primary ("unit") cooperative at the village level.

Prior to 1984, farmers could pay their water charges either in cash or in-kind. The bill from the FLIA office indicated the amount to be paid in cash, as well as the equivalent amount of rice, should the farmer opt to pay in-kind. For payments made in cash, the money was collected by the FLIA staff and brought to the head office of the FLIA, which subsequently remitted the amount to the county branch office of the National Agricultural Cooperative Federation. Delays in turning over the cash to the primary cooperative or branch office of the Federation and problems in the handling of cash by the FLIA staff were encountered with this system of collection.

Under the previous system, if the farmer chose to pay in-kind, he took his rice to the county National Agricultural Cooperative Federation warehouse. The quantity and quality were determined by an inspector of the Farm Products Inspection Office of the Ministry of Agriculture and Fisheries, who certified the grade of the rice, which was indicated on a bond issued to the farmer. If the rice failed to meet the minimum quality requirement, the farmer was not allowed to use it as payment in-kind. The bond issued to the farmer for "acceptable" rice was brought by the farmer to the FLIA office. If its value as indicated in the bond was less than the amount of the required water charge, the farmer had to pay the difference in cash. Likewise, if the value of his rice was greater than the water charge, the FLIA paid the farmer the difference in cash. These "cash adjustments" usually involved only small amounts of money. The bond which the farmer used as payment for the irrigation service fee was in turn used by the FLIA in withdrawing money from the county branch of the National Agricultural Cooperative Federation.

Two problems were encountered with the in-kind payment method. First, the Federation found itself with varying amounts of several different grades and yarieties of rice. Second, variations in the moisture content of the rice received from farmers introduced problems in the handling and postharvest processing. As a result of these problems, losses were incurred by the county branches of the Federation.

The present method of requiring farmers to pay for irrigation service fees in cash makes the accounting of the Federation simpler. The farmer sells his rice to the county branch of the Federation and pays his irrigation fees with part of the cash he receives from the sale. Both transactions can thus be done at a single place. In turn, the Federation is able to keep its rice purchases and collection of water charges in separate accounts.

Enforcement

Legally, the FLIAs are empowered, by Item 46 of the Rural Modernization Promotion Act of 1970, to collect water charges under the taxation authority given to local (county or city) governments. Although the FLIAs use the term *soo-ri-bi*, which implies a water "charge" or "cost" or "fare," the term "water tax" (*soo-sae*), commonly used by farmers and even by government officials, is a more accurate reflection of the legal reality.

Financial penalties exist for late payment of the water charges. They appear to have been first introduced in 1952 in response to problems of late payment and nonpayment of irrigation service

fees (Shim 1985). The current penalty is equivalent to five percent of the charge if payment is made within the first month after it was due. For each succeeding month, an additional 2 percent penalty is added, but with a maximum penalty limit of 15 percent. If a farmer has not paid when this ceiling is reached (i.e., the charge is six months overdue), the FLIA can initiate legal proceedings to sell the assets (excluding farmland, which by law cannot be sold for nonpayment of taxes) of the farmer to recover the charge. Wade (1982:87) notes that in such situations, the police can sequester assets of the farmer valued at the amount owned, and can sell them after 15 days if the farmer has still not paid. It appears, however, that this procedure is very rarely implemented, as most small-scale farmers have few assets that could be sold.

According to the chairman of the Paju FLIA, legal action has never been taken by the association against any farmer; a number of farmers, however, were penalized for late payment. In 1984, the Paju FLIA collected a total of 330,470,000 won in penalties from 418 farmers (about 2 percent of the members of the FLIA) for late payment. The amount collected in penalties was less than 0.2 percent of the total amount of water charges collected by the FLIA in 1984.

Termination of water deliveries to farmers who do not pay their water charges is not considered a realistic alternative, at least in the Paju FLIA. We were told that not only would it be physically difficult to do so (because water flows from field to field), but also that it would be inappropriate to do so, because of a feeling that the rice crop must be protected.

In addition to the strong penalties against those who do not pay, the FLIAs attempt to provide positive incentives for prompt payment. This is done through competitions. Within the area served by each field station of a FLIA, monetary prizes may be given to the first 3 villages to achieve 100 percent payment from all the farmers in the village. The value of the prizes varies among FLIAs. In 1984, the first prizes were 60,000 won in the Kiho FLIA (but reduced to 40,000 won in 1985 due to tighter budget conditions) and 70,000 won in the Pyongtaek FLIA. Field station staff who are the first to achieve 100 percent collection rates from the areas for which they have responsibility may also be given monetary prizes by their FLIA.

Collection Efficiencies

As implied by the discussion in the previous paragraph, rates of collection of water charges in the Republic are very high. Data for 1983 show that for the 103 FLIAs, collections were 98.3 percent of the amounts assessed. The accumulated amount in arrears was only 4.3 percent of total current assessments. Rates of collection in the 4 FLIAs visited during the study ranged from 96.4-99.5 percent.

Not all FLIAs are as successful as the above figures suggest, however. Six of the FLIAs (all of which are small, with less than 2,500 ha each) had collection rates below 90 percent in 1983, with the lowest being 81 percent. In several cases, these relatively low rates may simply reflect late payments. But in at least one case (a very small FLIA with less than 500 ha), the problem appears to be chronic, as the total amount of accumulated uncollected water charges is over 3 times the amount of current assessments.

Collection efficiencies have not always been high in the Republic of Korea.[4] During the period between the end of World War II and 1951, many associations suffered financial difficulties associated with unsatisfactory rates of collection, and a number of associations became insolvent. In 1952 the government established a regulation requiring the payment of fees in-kind rather than in cash, and added a financial penalty (a 10% surcharge) for late payment. Collection rates improved, with the average rate for 1952 being 83 percent of assessments. But this rate of collection was not sustained, and during the remainder of the 1950s the average collection rates varied from 70-80 percent. A gradual improvement in the rate of collection appears to have taken place during the 1960s, but to what extent this improvement was due to the government's more direct control over the affairs of the FLIAs, subsequent to changes made in 1958 and 1961 (which, among other things, reduced farmer control over the affairs of the associations, and provided for appointment of the chairman by the government), cannot be ascertained.

Collection Costs

To obtain meaningful data on collection costs would probably require in-depth case studies of some individual FLIAs. The new payment procedures initiated in 1984, which parallel the procedures used in the collection of other taxes, have probably lowered collection costs. But it would be extremely difficult to determine what proportion of the expenses of the cooperatives are associated with the collection of water charges for the FLIAs. Furthermore, it is possible that through the indirect effects which the collection of the water charges has on the cooperatives (see section on collections), there is a net benefit, rather than a net cost, to their collection activities.

Responsibility for the assessment and billing of water charges falls on the FLIAs. It appears that many field staff of the FLIAs spend significant amounts of their time in these activities, as well as in encouraging farmers to pay promptly. Some of these activities are undertaken during the winter months, when the irrigation system is not being operated. A meaningful analysis of the costs of these activities would require an evaluation of the alternative activities in which these personnel might be engaged, and of the change in staffing patterns which might be possible if these responsibilities were removed.

INDIRECT METHODS OF FINANCING IRRIGATION SERVICES

Secondary Income

Secondary income earned by the FLIAs is an important source of financing of irrigation services in Korea. This income is derived from a variety of sources, including the sale of surplus water outside the project or for non agricultural uses, rental of land owned by the FLIA, and interest on funds held by it. There is also a component (averaging three percent of the total revenues of the FLIAs) consisting of special government subsidies. On average, this secondary income accounts for approximately one-fourth of the total revenues of the FLIAs (Table 3.27).[5]

[4]This paragraph draws heavily on information in Shim (1985).

[5]The total revenues referred to are the total for the Ordinary Account of the FLIAs. This excludes the Special Account for Government Subsidy (into which the government subsidies for a portion of the capital costs of new irrigation projects, rehabilitation, and land consolidation flow to the FLIAs) and the Special Account for Farm Mechanization Program. Data on all three accounts are presented in the Yearbook of Land and Water Development Statistics 1984:Table 12.

Table 3.27. Source of revenues, by size of project and for selected FLIAs, 1983 (won/ha of assessed area).

	Irrigation service fees collected	Supplemental income	Total revenue	Revenue from irrigation service fees as % of total
All 103 FLIAs	151600	48200	199800	75.9
Medium-scale projects (50-5000 ha) (72 FLIAs)	155800	56100	211900	73.5
Large-scale projects (28 FLIAs)	158100	42700	200800	78.7
Very large projects (over 20000 ha) (3 FLIAs)	132100	47700	179800	73.5
Kiho FLIA	148100	65400	213500	69.4
Paju FLIA	183100	57600	240700	76.1
Pyongtaek FLIA	194500	41900	236400	82.3
Sosan FLIA	153600	62400	216000	71.1

Source: Agricultural Development Corporation (1984:Table 12).

Local Taxes

The Constitution of the Republic of Korea provides for the principle of local autonomy, which, among other things, gives local governments the right to assess and collect local taxes. In 1984, farmers paid three kinds of local taxes — a property tax on land, a housing tax based on the size and type of house, and a farmland tax on the production of rice and other crops. The provincial tax office at Suweon estimates that about 10 percent of the total budget of a county comes from these taxes. Although they are not designed to finance irrigation services, the amounts collected from the property and farmland taxes are affected by irrigation investments. It is thus appropriate to consider them as contributing indirectly to the financing of irrigation services.

Property tax. The property tax is paid by landowners registered in the land taxation book. For agricultural land, the tax rate of 0.1 percent is applied on the assessed land value. The valuation procedure for both urban and rural lands is as follows (Study Group on Asian Tax Administration and Research, 1983):

a) Maps or plans are drawn in order to establish current land classes.

b) Areas on the plans are grouped into several divisions according to the use or purpose of the land (residential, business, farm, and undeveloped). Boundaries are usually formed by rivers or roads.

c) A standard area is determined for each division which should at least be 10 percent of the area of the division. The value of the standard area is established on the basis of values of actual transactions.

d) A survey of market prices for standard lands is submitted to the Local Tax Council.

e) The value of a class of land is determined by adding or subtracting a certain amount to or from the market price of its standard land according to the conditions of the land concerned.

Among the adjustment factors considered in determining the value of agricultural lands are 1) the condition of irrigation and the quality of water, and 2) the dangers due to flood. The value of the land can be expected to be adjusted upwards to the extent that the irrigation infrastructure is able to provide for quality irrigation services and, through the related drainage and flood control facilities, to reduce the dangers due to flood. It is the increase in the property tax due to these adjustments that represents an indirect recovery by the government of the costs of its irrigation investments.

The property tax is payable from 16-30 September each year. A demand note is issued within seven days after the end of the payment period. A 5 percent penalty is added to the calculated amount of unpaid tax if the taxpayer fails to pay within 90 days after the end of the payment period.

Farmland taxes. Farmland taxes are related to income. Irrigation is likely to affect cropping intensities and yields, both directly and indirectly through the complementarity between irrigation and other production inputs such as fertilizer. Assuming that these effects are reflected in higher incomes, the amounts collected from the farmland tax will increase.

Within 10 days after harvest, a farmer is required to report, to the county office in which his farmland is located, the production of his farm. In the absence of detailed farm records on production costs, the net income is determined on the basis of standard guidelines. The guidelines on the production cost of major crops such as rice and barley are prepared by the Ministry of Agriculture and Fisheries, while those for minor and specialty crops like fruits, ginseng, tobacco, vegetables, nursery crops, etc. are prepared by the Office of Rural Development. These recommended guidelines are submitted to the Ministry of Interior, which has the final authority on the adoption of the guidelines. The farmers are informed by their county government of the "basic production" for different classifications of land and the "necessary expenses" to be used in determining production costs.

The acceptable levels of production, as well as the allowable cost of production inputs may be adjusted to reflect the productivity of the farms in a specific area. In some cases, the production figures may be underestimated for political and socioeconomic reasons. While the tax rates and the exemption rate are fixed, the parameters in determining the incomes — the "acceptable" production yields and "necessary" production costs — are flexible and negotiable. Moreover, determining the actual production and the related production costs in a farmland planted to different crops may be hard to implement in actual practice.

Tax for the income earned during the period 1 January to 30 June (summer crop) must be paid between 15-31 July, while income earned from 1 July to 31 October (usually the rice crop) must be paid between 15-30 November of the same year. A penalty of five percent is added to unpaid farmland taxes after the due date for payment.

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Tax exemptions or reductions of taxes are possible in the case of crop failure due to drought or flood. The extent of the damage is determined by the Ministry of Agriculture and Fisheries, which also determines the amount of reduction in taxes to request from the Ministry of Finance. The provincial government reports to the central government on the damage and requests a supplementary budget to offset the reduction in taxes. The provincial government allocates to the counties any supplementary budget received from the central government.

RELATIVE CONTRIBUTION OF FARMERS TO IRRIGATION FINANCING

In evaluating the contribution of farmers to irrigation financing, it is useful to separate the contribution made directly by the farmers, from the total contribution made by the FLIAs. In Table 3.28, average O&M costs and the average water charges, both calculated per hectare of assessed area, are presented for the various sizes of FLIAs, and for the four FLIAs visited during the study. As shown in the final column, Table 3.28, for all sizes of projects, the average water charge is equivalent to 88-92 percent of the average O&M cost. The corresponding figures for the four FLIAs visited were somewhat higher. In the case of the two projects with recent Asian Development Bank and World Bank financing (Paju and Pyongtaek), the higher water charges, reflecting the higher project-repayment costs of recently constructed projects, resulted in total charges somewhat in excess of the O&M cost.

Farmer payments average less than O&M costs while the farmer organizations that manage the irrigation projects are generally responsible for all O&M costs plus a portion of the capital costs and this reflects the fact that the FLIAs have secondary income in addition to the irrigation service fees they collect from farmers. As noted above, this secondary income accounted for an average of approximately one-fourth of the total revenues of the FLIAs (see Table 3.27).

Indirect subsidies underlie some of these components of FLIA income. For example, FLIAs generally hold reserve funds which can be deposited with either the National Agricultural Cooperative Federation or the Federation of Farmland Improvement Associations, where they earn a 10 percent interest. At the same time, the FLIAs are allowed to borrow funds from the National Agricultural Cooperative Federation for certain types of long-term irrigation improvements or repairs at 5.5 percent interest, with a 30-year repayment period.

It is not possible to determine accurately the total magnitude of government subsidies for irrigation services. A general idea of the order of magnitude of the subsidy can be obtained by constructing a hypothetical example of an irrigation project, based on typical figures for various cost components. The results of one such set of calculations are presented in Tables 3.29 and 3.30.

Table 3.28. Average O&M costs and irrigation service fees assessed, per hectare of assessed area, by size of project and for selected FLIAs, 1983.

	O&M cost (won/ha)	Average irrigation service fees assessed		Water charge as % of O&M cost
		(won/ha)	kg rice[a]/ha	
All 103 FLIAs	168200	156300	310	92.9
Medium-scale projects (50-5000 ha) (72 FLIAs)	169800	156100	310	91.9
Large-scale projects (5000-20000 ha) (28 FLIAs)	172700	158600	315	91.8
Very large projects (over 20000 ha) (3 FLIAs)	156500	137800	273	88.1
Kiho FLIA	160100	148700	295	92.9
Paju FLIA	161300	188600	374	116.9
Pyongtaek FLIA	188500	201700	400	107.0
Sosan FLIA	162700	155300	308	95.5

[a]Unmilled rice.

Source: Agricultural Development Corporation (1984:Tables 11, 12).

Table 3.29. Hypothetical annualized cost of irrigation services, assuming net construction costs of 5 million won/ha.

	Total cost	Cost to FLIA
Net construction cost	5000000	1500000[a]
Design (3% of net)	150000	0
Supervision of construction (10% of net)	500000	0
Subtotal	5650000	1500000
Interest during construction[b]	1725000	0
Total cost at end of construction	7375000	1500000
Annualized value	743800[c]	52000[d]
Annual O&M costs	185000	170000
Total annualized cost	928800	222000

[a]Assumed to be 30 percent of total.

[b]Assuming a 5-year construction period, average investment equal to 50 percent of the subtotal, at 10 percent interest.

[c]Assuming a 50-year life, at 10 percent interest.

[d]Annual amount whose present value is equivalent, at 10 percent interest, to the present value of the required payments of 88,100 won/year for 30 years, following a 5-year grace period. (Annual payments of 88,100 won for years 6-35 are based on loan for 1,500,000 won plus 262,500 won interest over a 5-year grace period amortized over 30 years at 3.5 percent interest).

Table 3.30. Distribution of hypothetical annualized total cost of irrigation services, by size of capital cost.

Size of capital cost ('000 won/ha)	Hypothetical annualized total cost of irrigation service (won/ha)[a]			Percent of costs paid by			
				FLIAs		farmers through irrigation service fees[c]	
	Total	Paid by FLIAs	Paid by farmers through irrigation service fees[b]	O&M	Capital	O&M	Capital
3000	631300	201200	150900	100.0	3.6	80.7	0.0
5000	928800	222000	166500	100.0	5.0	89.0	0.0
7000	1043520	242800	182100	100.0	6.7	97.4	0.0
9000	1336840	263600	197700	100.0	6.8	100.0	1.1

[a]Calculation of total costs and costs paid by FLIAs based on Table 3.25.

[b]Assumes irrigation service fees represent 75% of total revenues of the FLIAs.

[c]Partitioning between O&M and capital is based on the hypothetical assumption that funds from irrigation service fees are credited to capital costs only after all O&M costs are covered by these fees. In actual fact, an individual farmer's irrigation service fee has an O&M component and a capital cost component, even when the O&M component is less than the full cost of O&M. In 1983, the average capital cost component was 23% of the average irrigation service fee.

The details for the calculations based on a net construction cost of 5 million won/ha are presented in Table 3.29. It is assumed that the nominal government subsidy on the net construction cost is 70 percent. Additional costs, completely subsidized by the government, are design, supervision of construction, and interest during construction. The design and supervision of construction are undertaken by the ADC, from which the cost estimates were obtained. A relatively low market rate of interest of 10 percent was assumed in the calculations. In calculating the annualized value of the total cost, a 50-year life for the project was assumed. In calculating the corresponding figure for the FLIA cost, the average annual payment required to repay the initial loan plus accrued interest during a 5-year grace period was calculated. This is based on the government regulations that provide for an interest rate of 3.5 percent, and a 30-year repayment period, following the grace period.[6] The present value of these 30 payments was then calculated, and annualized for a 50-year period. Thus the annualized value of the capital costs to the FLIA represents the annual payment which, if made over the assumed 50-year life of the project, would have the same present value as the payments it is required to make during years 6 through 35.

The O&M cost shown in Table 3.29 as borne by the FLIA is approximately the same as the average annual O&M costs of the FLIAs, of 168,200 won/ha (Table 3.28). The additional 15,000 won/ha added to arrive at the total cost of O&M reflects the subsidy for electricity costs. It is equivalent to about half of the subsidy estimated in section on price policies for inputs other than water for the Pyongtaek FLIA, which relies heavily on pumping.

The results from Table 3.29 are again presented in Table 3.30, along with results for similar calculations based on alternative assumptions about the initial capital cost. The values chosen reflect a representative range of the values given in Tables 3.10-3.14.

[6]As explained in note 1, the effective rate of interest to the FLIAs is 3.5 percent even though the nominal rate is 5.5 percent.

The last four columns of Table 3.30 are designed to indicate the proportion of capital costs covered by payments — those of the FLIA in the case of the first two of these columns, and those paid directly by the farmer through water charges in the last two. The numbers indicate that the amounts paid by the FLIAs would cover all of the O&M costs plus 4-7 percent of the capital costs, depending on the amount of the initial capital investment. Considering only the payments by the farmers through the water charges levied on them, in most cases the charges are somewhat less than the total O&M cost. Only in the case of the project with the highest capital cost — 9 million won/ha — were the charges enough to cover all O&M costs. In this case, there was a contribution to the capital cost of approximately one percent.

Although these figures represent a hypothetical situation, they are indicative of the order of magnitude of farmer payments and government subsidies in the Republic of Korea.

EVALUATION OF FINANCING POLICIES

Korean policies for financing irrigation can be evaluated from the perspectives of both economic efficiency and income distribution.

Efficiency in Water Use

The methods of irrigation financing used in Korea provide no direct incentives for individual farmers to increase their efficiency of water use. While farmers are keenly aware of the high cost of irrigation, there is no mechanism whereby a farmer can effectively reduce this cost through more efficient use of water. The charges which he must pay are not based on the amount of water used, the number of irrigations, or the type of crop grown.

It might be argued that because water charges are high, farmers have an indirect incentive to try to be efficient in the use of water so that it will not be necessary for the FLIA to invest in additional sources of water (frequently involving pumping) that might increase the charges which all farmers in the FLIA would have to pay. But the large size of the FLIAs (typically ranging from 2,000 to over 10,000 members, with an average of over 8,000), and the lack of farmer participation in the decisions and activities of the FLIAs makes it unlikely that such an indirect mechanism would be an effective means of encouraging efficiency in water use.

Efficiency of water use in the Republic is thus related to the effectiveness of FLIAs' control over the distribution of the supply of water to individual farmers, rather than the control over the demand for water through pricing mechanisms. The extent to which the FLIAs achieve efficiency in the use of water is not clear. During most of the irrigation season, and during most years, water is relatively abundant, making efficient use of water somewhat less critical than in other countries where water is much scarcer. On the other hand, to the extent that irrigation water is pumped, inefficiencies may considerably increase the cost of irrigation operation. There have been reports suggesting that inefficiency in the management of irrigation may be a problem (Kim 1982, Wade 1982).

Efficiency in Investment

The requirement that the FLIA incur a long-term loan to cover a portion of most investment costs means that farmer payments for water will be affected by investment decisions. The extent to which this results in more efficient investment decisions is not clear. For investment decisions made at the level of the central government, the sensitivity to the level of payments which farmers are required to make for irrigation may lead to a more careful scrutiny of proposed investments. But the effectiveness of this may be reduced both by the fact that the farmers' ability to pay is significantly affected by the level of rice prices, which the government has maintained at high levels, and by the existence of special subsidies to those FLIAs which would otherwise be burdened with very high payments. Considering that the central government effectively bears most of the capital cost of irrigation investments, the size of the budget available to the Ministry of Agriculture and Fisheries for irrigation activities may be a more critical factor in investment decisions than the amount of water charges that farmers will have to pay.

For investment decisions taken at the level of the FLIA (such as decisions regarding new irrigation facilities, or improvements in existing facilities), concern over the effect of the decision on the water charges to farmers may encourage a careful weighing of the benefits and costs of proposed investments. On the other hand, to the extent that proposed investments represent a substitute for more careful management of the water, as appears to have been the case in the FLIA studied by Wade (1982), many of the benefits of the investment may accrue largely to the staff of the FLIA, rather than to the farmers. Given the lack of farmer participation in the decisions of the FLIA, the fact that a proposed investment may increase water charges may have little bearing on the ultimate decision made by the FLIA.

Efficiency in Management

One of the presumed advantages of financing arrangements that involve decentralized organizations with a substantial degree of financial autonomy is that the financial accountability linkages between the managers of the irrigation system and the users of the irrigation water will lead to more efficient management — both in terms of effective provision of irrigation water to the farmers, and in terms of control over the expenditures for O&M.

In Korea the FLIAs are decentralized and have a substantial degree of financial autonomy. As several observers have noted, however, the FLIA is not a participatory farmers' organization (Kim 1982, Steinberg et al. 1980, Wade 1982), but rather "a bureaucratic entity designed to deliver water and collect water fees" (Steinberg et al. 1980:10). Farmers have little active involvement in the affairs of the FLIA. This lack of farmer involvement and participation in the FLIAs has been cited as "one of the main sources of inefficiency in the management of irrigation systems" (Kim 1982).[7]

As a result, the financial accountability linkages between the FLIAs and the farmers are very limited. The strong incentives and sanctions associated with farmer payment of water charges may severely limit the extent to which farmers can use the payment of water charges as leverage to achieve accountability within the FLIA (Wade 1982).

[7]It is not clear, however, that there would be fewer management problems under a more participatory approach. The rationale used by the central government to take control of the FLIAs in 1961 (at which time the general farmer meeting and the election by farmers of FLIA officials were abolished) was "to restore sound management to the FLIAs" (Kim 1982b:185).

Although the accountability linkages to the farmers are weak, the FLIAs are not free from control over expenditures. Financial accountability extends upward from the FLIAs to the provincial governments and to the Ministry of Agriculture and Fisheries. It is possible that this accountability, coupled with the sensitivity that exists within the central government to the financial burden which irrigation imposes on farmers, may lead to an effective system of control over the O&M costs of the FLIAs.

Income Distribution between the Public and Private Sectors

Irrigation results in a net expenditure of public funds in Korea. It is likely that, in economic terms, considerably less than 10 percent of the initial capital cost of irrigation is recovered from the FLIAs, in spite of levels of irrigation service fees which are seen as very high even at rice prices which are approximately double those that would prevail in the absence of government controls over imports.

On the other hand, the recurrent costs associated with the O&M of irrigation facilities in the Republic do not represent a continued drain on public resources. With the exception of an implicit subsidy to irrigation operations associated with the pricing structure for electricity, the costs of irrigation O&M are paid for entirely by the FLIAs, largely through the water charges paid by farmers, but partly through secondary income of the FLIAs.

Income Distribution within the Private Sector

The general subsidy of the capital costs of irrigation by the government represents a transfer of income from taxpayers to farmers. In general, this implies a redistribution from the urban population to the farmers. This is consistent with general government policy designed to achieve a parity between urban and rural incomes.

Government price policy for rice also implies a redistribution from rice consumers (the majority of whom are urban) to rice farmers. To the extent that the high rice price policy permits higher water charges than would otherwise be possible, the need for irrigation to be subsidized from government revenues is reduced. It would thus appear that through this price policy, part of the burden of redistributing income to agriculture associated with irrigation is shifted from the general taxpayer to rice consumers.

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Developing Financially Autonomous Irrigation Institutions in Korea An Historical Case Study

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DEVELOPING FINANCIALLY AUTONOMOUS IRRIGATION INSTITUTIONS IN KOREA: AN HISTORICAL CASE STUDY

INTRODUCTION

Irrigation is an important component of the physical environment in which rice is produced in Korea. Over 70 percent of the land used for rice cultivation in South Korea is classified as irrigated, with the remainder classified as partially irrigated. The operation of the irrigation facilities serving these fields is the responsibility of decentralized associations of two general types. Informal Farmland Irrigator's Groups are responsible for the operation of small [less than 50 hectares (ha)] irrigation projects. In total, these groups are responsible for about half of Korea's irrigated area. The remaining half is served by 103 Farmland Improvement Associations (FLIAs) which operate under the general guidance of the Central and Provincial governments (Table 3A.1).

Table 3A.1. Status of irrigation in South Korea, 1955-1984.

Year	Total area under rice ('000 ha)	Total area irrigated		% of irrigated area served by	
		('000 ha)	% of total rice area	FLIAs	Informal groups
1955	1187	407	34	51	49
1960	1206	499	41	49	51
1965	1286	538	42	53	47
1970	1284	745	58	43	57
1975	1277	790	62	46	54
1980	1307	893	68	47	53
1985	1325	948	72	50	50

Source: Ministry of Agriculture and Fisheries (1981,1986), Statistical Yearbook of Agriculture, Forestry, and Fisheries.

The government supervises and controls these Farmland Improvement Associations to a significant degree, but they represent a relatively decentralized approach to irrigation administration. Furthermore, though the government subsidizes the cost of constructing major irrigation facilities, the FLIAs have a significant degree of financial autonomy. A key element in this financial autonomy is the arrangement by which each FLIA's operating budget depends to a great degree on the irrigation service fees which it charges its members. Assessed fee collection is close to 100 percent.

The Korean experience with institutional arrangements for financing and operating irrigation contrasts with those of many other countries in South and Southeast Asia. In a study of irrigation financing arrangements in five Asian countries, Small, Adriano, and Martin (1986) argue that the institutional arrangement of financial autonomy is an important element in endeavors to improve the management of irrigation projects, and recommend the promotion of financial autonomy in countries where it does not exist. Achieving financial autonomy, however, where it does not already exist, is difficult, requiring significant institutional changes. A transitional stage in which a variety of organizational and financial problems are experienced can also be anticipated in this process.

Korea has been relatively successful both in achieving financial autonomy in its irrigation institutions and in maintaining the viability of that autonomy through high collection rates of assessed water charges. Therefore, it is useful to examine the financial facet of the history of the Korean irrigation experience to gain further insight into the processes from which these important features of irrigation emerged.

OVERVIEW OF THE DEVELOPMENT OF KOREAN IRRIGATION INSTITUTIONS

Most irrigation facilities in Korea have been developed to produce rice, and to supplement the relatively abundant but somewhat erratic rainfall. Generally, one irrigated crop of rice is grown per year, although either barley or vegetables may be grown without irrigation, or with some irrigation provided by individual farmers, during the winter months. Early transplanting in May is important in obtaining high yields, and is frequently facilitated by irrigation.

Korea has a long history of rice cultivation. Although no concrete records exist to show its beginnings, one report states that rice cultivation began in 33 A.D. during the Beck-Jae Dynasty (Korean Rural Economics Institute 1985:10). The first reported irrigation facility is the embankment of Byeck-Gol-Jae which was built in 330 A.D. to use river water for farming (Union of National Irrigation Associations 1967:459-464). Although kings of subsequent dynasties may have been concerned about irrigation, no significant construction of irrigation facilities was initiated by them. Their irrigation-related activities were limited to encouraging farmers to build embankments, weirs, and reservoirs on available farm lands, and to officiating at rain-making ceremonies in dry years.

It seems unlikely, however, that many farmers were interested in building irrigation facilities in ancient times as all land belonged to the state, and any farmer who built an irrigation facility would probably not have been assured of receiving its benefits.

It is reported that there were only about 6,000 embankments and 20,000 weirs built by the Chosen or Yi dynasty kings between 1392 and 1909 (Japanese Government General in Korea 1937:11). Toward the close of the dynasty, more than half of them were of only limited effectiveness as most of these facilities were old and not well-maintained. Natural disasters occurred quite often, partly as a result of insufficient irrigation facilities. For example, Chosen dynasty records report 89 major droughts in 482 years and 89 floods in 492 years (Japanese Government General in Korea 1928:21-99).

Modern irrigation development in Korea began early in the 20th century. In March 1906, a decree entitled "Ordinance of Irrigation Associations" was issued by the Ministry of Finance (Annex 1). This brief ordinance was the first legislative measure concerning irrigation organization, and represented a milestone in the development of irrigation in Korea. The ordinance authorized all irrigation associations to manage the irrigation and reclamation of lands by imposing fees and obligations in-kind (i.e., materials, labor, and even land) necessary for the construction and operation of irrigation facilities (Japanese Government General in Korea 1935:93).

In February 1908, the first irrigation association, Okku West Association, was formed under this ordinance. This association had an irrigated area of only 490 ha. Five additional associations were formed over the next two years: Milyang (633 ha), Yeansan (310 ha), Jeanik (1,549 ha), Imik South (2,400 ha), and Imik (2,598 ha) (Korean Farm Association 1917:49- 61).

During the period of Japanese rule, which began in 1910, the government established policies and programs designed to increase rice production by developing irrigation facilities and improving seed quality. But, by 1917, only six new irrigation associations had been established, the largest of which, the Taejong Irrigation Association, had an area of over 11,000 ha, which was nearly half of the total irrigated area in that year (Annex 2).

Believing that the creation of new associations was slow due to shortcomings in the Irrigation Ordinance, the Act on Korean Irrigation Associations was promulgated in July 1917 (Korean Farm Association 1917:49- 61). The law made the irrigation associations juridical entities, and provided a legal basis for collecting association fees by methods comparable to those used for collecting other taxes. It also set forth details on the establishment, abolishment, merger, or division of irrigation associations; on changes in the service areas covered; on finance; and on the operation of the associations.

Subsequent to the passage of this law, and influenced both by the high prices of rice which prevailed following the year 1918 (Annex 3) and by a government program for increasing rice production launched in 1920, the amount of irrigation facilities and the number of irrigation associations increased substantially. But many associations encountered financial difficulties, leading the government to promulgate another Act on Korean Land Improvement in December 1927. This Act, as amended in July 1928, provided for a government subsidy on the development of irrigation, flood control, reclamation, and land consolidation. It also provided for the dissemination of new seeds and other agricultural inputs to promote better farming in the service areas of the irrigation associations.

Because of the new Act, many farmers expected that he operation of irrigation associations would be easier than before, and the number of associations increased rapidly, reaching 193 by 1931 (Annex 2). But falling rice prices in the early 1930s, resulting from the worldwide recession, led the government to suspend its program for increasing rice production. Although the number of irrigation associations stabilized at about 190, many of them failed to attain their original targets on irrigated area and production.

The Sino-Japanese War began in 1937. As the war continued, and as the food situation deteriorated due to a severe drought in 1939, the government again promoted a plan to increase rice production. Following the establishment of a Union of Irrigation Associations in July 1940, the number of irrigation associations increased rapidly. A total of 353 new irrigation associations, covering an area of 120,486 ha, were organized during the 6 years from 1939 to 1945 (Union of National Irrigation Associations 1956:92-93). But many of the irrigation facilities built during this period were not properly completed due to shortages of materials. As a result, they soon needed a great deal of repair and many of them ceased functioning.

Following Korea's independence from Japanese rule in August 1945, the country was divided into two parts, South and North Korea. Of the 583 irrigation associations in existence in 1945, 425 associations covering about 188,000 ha were located in South Korea (Union of National Irrigation Associations 1956:97,366). But many of these associations faced financial difficulties which were compounded by the political and economic disruptions of the mid-1940s. With the establishment of an independent South Korean Government in August 1948, certain measures were taken to deal with the problems of the irrigation associations. These included provision of salaries for the heads of the associations by the central government and the reorganization of the Union of National Irrigation Associations in June 1949.

In response to several government initiatives, the number of irrigation associations increased from 442 in 1950 to 668 by 1955, despite the adverse effects on progress brought forth by the Korean War of 1950-1953. The first initiative was the passage in 1952 of legislation for the Special Account for Farmland Improvement Programs, which provided funds for the construction of new irrigation facilities. A second initiative followed the next year when the Ministry of Agriculture and Forestry, recognizing the possibility of using irrigation associations to promote some of its farmland improvement programs, issued guidelines for the Expansion of Farmland Improvement Facilities. These guidelines allowed all associations to recruit technical staff by themselves, earmarked funds for additional programs, and gave farmers the option of paying association fees in cash or in-kind (unmilled rice). The third initiative that stimulated the growth of irrigation associations occurred the same year (i.e., in 1953), when the central government delegated authority to the provincial governors to grant the various permissions required for the organization of new irrigation associations.

In the late 1950s, the persistence of financial problems in many associations, and the tendency of the associations to be very small in size led the government to undertake efforts to merge irrigation associations. The government's objectives were to enlarge the service area of individual associations, and to permit insolvent associations to be merged with financially viable associations. The Ministry

of Agriculture and Fisheries provided the provincial governments with guidelines for such mergers in 1959. But conflicting interests among the irrigation associations thwarted this initial effort.

The government then made major legislative changes in 1961, passing the Law on Temporary Measures Concerning the Merger of Irrigation Associations, and replacing the 1917 Act on Korean Irrigation Associations with the Law of Land Improvement Projects. Under the latter law, these revamped associations became known as Land Improvement Associations. The Law on Temporary Measures Concerning the Merger of Irrigation Associations was designed to promote more effective management of the associations by increasing their size to a scale deemed to be more economic, and by eliminating insolvent associations that had been established on a weak economic basis during the latter part of the 1950s. This law also removed from the members of the associations the right to elect the associations' officers, which they had enjoyed since 1952. The power to appoint irrigation association heads and councils was given to the Minister of Agriculture and Fisheries.[1]

Implementation of the new law was swift, and in less than a year the number of associations had dropped from 695 to 198. But some of these mergers created problems, particularly where they resulted in a single association responsible for unrelated service areas scattered over a large geographic region. These problems led, in 1964, to an amendment to the Law of Land Improvement Projects to allow the division of associations under certain conditions. Twenty-four associations subsequently reverted to their status prior to the mergers. Thus, by the end of 1965, the number of associations stood at 222 (Annex 2).

As the service area of the individual associations increased through mergers the number of farmers belonging to a single association also increased. To facilitate communication between the leadership and members of the associations, the Ministry of Agriculture issued instructions in August 1964 for the organization of "agricultural promotion groups" known as *Hueng-Nong-Gye* (HNG). Geographically, one HNG covers one village, and it appears that in reality, the HNG seldom functions separately from the village administration (Wade 1982:82-84). The key figure in the HNG is the HNG leader, who, in most cases, is appointed on the basis of the recommendation of the village administrative head (Wade op. cit.). He serves as a vital communication link between the officials of the irrigation associations and the farmers. This link is particularly important in matters involving the assessment and collection of association fees.

The 1961 Law of Land Improvement Projects was replaced in January 1970 by the Law for Rural Modernization Promotion. Reflecting the government's increased concern with promoting agricultural production, this new law dealt not only with land improvement or irrigation problems, but also with the adoption of new agricultural technology. There was particular emphasis on the promotion of technology to alleviate the shortage of farm labor which was emerging as a result of the nation's urbanization and industrialization. The law also had provisions designed to result in improvements in rural living conditions, chiefly through improvements in farm houses, and provision of potable water and farm roads.

An important institutional development under the new law of 1970 was the establishment of the Agricultural Development Corporation (ADC). The ADC was created through a consolidation of

[1]Although this authority was given under a "temporary" measure, it has remained with the same Minister to date.

the Union of Land Improvement Associations, which had been established in 1940 but which in 1949, was reorganized with the Groundwater Development Corporation. The ADC is a semi-autonomous, government-funded enterprise which operates under the auspices of the Ministry of Agriculture and Fisheries. As a special juridical entity, the ADC is responsible for the design and construction of large irrigation, drainage, and flood control projects. In the case of smaller projects implemented directly by the individual irrigation associations, ADC provides technical assistance and supervision of construction.

In September 1971, the Land Improvement Associations were renamed Farmland Improvement Associations (FLIAs). At the same time, a new private corporation, the Farmland Improvement Association, was created at the national level to promote some linkages among the FLIAs. Two years later, this organization was renamed the Union of Farmland Improvement Associations. The Union assisted in the implementation of various farm improvement projects and also supplied agricultural inputs for farmers in the service areas of the FLIAs.

In spite of these efforts, FLIAs continued to experience financial difficulties. Many of them were unable to raise enough funds to cover their operation and maintenance (O&M) expenses. The Ministry decided to proceed with further mergers of small FLIAs. As was the case with earlier mergers, it was hoped that this would improve the financial status of the associations by reducing their operating expenditures per hectare. Thus in 1973, the existing 266 FLIAs were merged and reduced to 127. The size of the staff of the associations was also reduced.

In April 1978, the Union of Farmland Improvement Associations was replaced by a public corporation, the Federation of National Farmland Improvement Associations. The Federation continued to merge the small and economically ineffective associations. The mergers were completed by 1980. The current number of 103 FLIAs is a result of these mergers.

At the instruction of the Minister of Agriculture and Fisheries, steering committees were organized in the associations in June 1982. The purpose of these committees is to promote better function of the associations by expanding the members' participation in the operation of associations. These committees are composed of 8-30 members, depending on the size of service area of each association. Members are selected from among the heads of the HNG included in the service area of the FLIA. The function of the committees is to deliberate over the annual budget and the settlement of expenses, to determine association fees, and to act on the acquisition or disposal of association properties.

In addition to the formal Farmland Improvement Associations, Korea also has a large number of small and informal "irrigation groups." Each of these groups generally irrigates an area of less than 50 ha. Detailed centralized records do not exist on these associations, but the total area irrigated by them in 1985 was reported to be 476,800 ha, or roughly the same as the area irrigated by the 103 FLIAs. These organizations are financially autonomous, and have minimal involvement with the central government, although they may receive subsidies from local governments for the construction of the irrigation facilities. Detailed information on these associations is found in a study based on a sample of 64 of these projects (Oh 1978). An examination of the development of these associations is beyond the scope of this paper.

KEY FINANCIAL ISSUES UNDERLYING THE DEVELOPMENT OF KOREAN IRRIGATION INSTITUTIONS

The developments in Korean irrigation institutions over the past 80 years reflect three dominant institutional issues related to irrigation financing: 1) achieving a balance between decentralization and centralization in irrigation administration and financing, 2) establishing enforceable and politically acceptable irrigation fees, and 3) maintaining financial autonomy within a system of government subsidies.

Achieving a Balance between Decentralization and Centralization in Irrigation Administration and Financing

Decentralization versus centralization. Throughout the 20th century, decentralization has been an important feature of Korean irrigation. Responsibility for the O&M of most irrigation facilities is decentralized. Unlike many other countries in Asia, Korea has no national irrigation agency responsible for operating government irrigation schemes throughout the country. Instead, the large number of independently managed FLIAs are responsible for O&M services. This concept of decentralization in the operation of irrigation seems never to have been questioned in the period of modern irrigation development in Korea. Korea's system of decentralized irrigation associations, based on the Japanese model, was a feature of the original Irrigation Ordinance that remained unchanged through the subsequent laws which replaced it. But the extent and nature of decentralization have evolved over time.

Extent of decentralization: the size of irrigation associations. During periods when the irrigation associations experienced financial difficulties, a typical response of the government was to encourage the merger of small associations into larger ones. Larger associations were seen by the government as more efficient because they could spread the overhead costs of administrative personnel over a larger area. Combining a number of small associations that were not always either physically contiguous or hydraulically connected reduced the extent of decentralization.

A policy for merging small associations was first implemented by the Japanese colonial government in 1935 as part of a general effort to improve the financial operation of associations. This policy emerged from the government's review of the financial viability of irrigation associations. This review was triggered by the problems that the associations encountered as world rice prices dropped (Japanese Government General in Korea 1935:740-741). The policy was to attempt to merge associations having less than 200 ha of service area with larger associations in order to increase their financial viability.

The extent to which this policy was successful is not known, but it had little impact on the average size of the irrigation associations. In 1919, when there were only 15 associations in existence, the average size was 2,700 ha. During the 1920s, as the number of associations grew, the average size gradually dropped to about 1,200 ha. Little change in either the total number of associations or in their average size occurred during most of the 1930s. But beginning in 1939 there was a sharp

increase in the number of associations and a marked decrease in the average project area, so that by the end of World War II, the average size of association was only 600 ha. As associations tended to be larger in the northern part of the country than in the south, postwar South Korea emerged with 425 associations having an average size of only 443 ha (Annex 2). Furthermore, data on the size distribution of associations in 1945 reveal that 3 of these associations (2 in Jeunbuk Province and 1 in Whanghae Province) accounted for 35 percent of the total area served. At the other extreme were 350 associations with less than 300 ha each, and averaging only 134 ha (Annex 4). Although there were a modest number of mergers in the first 15 years following World War II, the number of associations continued to rise, reaching nearly 700 by 1960, with very little change in their average size (Annex 2).

When the government again addressed the financial problems of the irrigation associations in 1959, it attempted, as in the 1930s, to merge associations in order to gain the economies of scale associated with more centralized management. But this type of centralization was unpopular among the associations, and the government was unsuccessful in its initial efforts to implement the merger policy. It was not until 1961, with the passage of the Law on Temporary Measures Concerning the Merger of Irrigation Associations, that the merger policy was implemented. The subsequent merger of 695 associations into 198 resulted in a considerable increase in the degree of centralization of management of the associations. Implementation of the policy undoubtedly required a strong dose of central authority — an authority which was strengthened by the provision of the law permitting the Minister of Agriculture and Fisheries to appoint the heads of the associations. But the degree of centralization achieved by the 1961 merger was unpalatable, as indicated by the fact that the government was forced to modify its policy in 1964 and permit the reestablishment of 24 of the associations which had been merged 3 years earlier.

During the remainder of the 1960s, the number of associations increased, reaching 266 in 1970. Once more the government felt that merging was the solution to many of the financial difficulties of the smaller associations, and a new effort to merge associations was undertaken. The number was reduced from 266 in 1970 to 127 in 1973. A very small number of mergers took place in 1977, and in 1980 another 20 associations were merged with larger ones, reducing the number of FLIAs to its current level of 103.

Most of the 103 FLIAs are divided into irrigation units, which are under the management of substations. These substations, which numbered 915 in 1985, are rather like mini-irrigation units. Many of them were established on the basis of their water source, and were originally independent associations. The increased degree of centralization, stemming from the desire to spread management overhead costs over larger areas, has thus led to the current situation in which associations are typically responsible for somewhat scattered service areas.

Although the irrigation associations are still decentralized, there are 103 independent entities providing irrigation services in their respective areas. The mergers that have taken place, particularly since 1960, have significantly altered the relationship between the individual member and the management of an association. The psychological distance between the farmers and the irrigation association officials has increased. Individual farmers now have relatively little direct involvement

in the affairs of the irrigation associations of which they are members. The establishment, in 1964, of an institutional arrangement whereby one individual in each village (the *Hueng-Nong-Gye* leader) would serve as a liaison between the farmers and the irrigation associations shows the government's attempt to deal with the problems created by this increased centralization.

Nature of decentralization: the role of the central government. Although the irrigation associations are decentralized, there has always been provision for a significant degree of government supervision and control over their affairs. The concept of government regulation and supervision of the associations is evident in the original Ordinance of Irrigation Associations of 1906 which gave the central government powers to approve the establishment of associations, to appoint a person to control and supervise the management of the associations, to approve the appraisals undertaken, to assess the irrigation fees, to require that certain amounts of the association's funds be held on deposit, to approve an association's undertaking new indebtedness, and to require budget reports from the associations (Annex 1).

Over the years, the government has increased financial aid to the associations and its control over them as well. This control operates through administrative and budgetary regulations, through supervision of an association's financial affairs, and through the appointment of key association personnel.

Each association must prepare its annual budget for approval by either the central or the provincial government. Detailed guidelines are laid down for the preparation of these budgets. For example, the guidelines for budgeting for fuel costs for office facilities specify the maximum temperature to which a FLIA office may be heated in the winter. The financial affairs of the associations are also supervised by the government through its financial audits, and through the requirements of its approval process for government loans to the associations.

The appointment of key association personnel has become an important factor in the government's control of the irrigation associations. Although the 1906 ordinance provides for the appointment of association officials by the government (Annex 1:Article 4), democratic procedures were introduced subsequent to Korea's independence from Japanese rule. As previously noted, however, since 1961, the right to select the association head and council has been given to the Minister of Agriculture and Fisheries. This has led the associations to orient their operations more toward the government and its policies, and has placed the participation of the members of the association on a mandatory rather than a voluntary basis.

Establishing Enforceable and Politically Acceptable Irrigation Fees

The original Irrigation Ordinance of 1906 authorized associations to collect fees from their members to cover their expenditure. As in the case of the concept of decentralization, the principle that the operating budgets should be funded primarily from fees collected from their members has remained intact throughout the 80-year history of the associations.

But during this period an awareness has evolved that this method of gaining financial autonomy can impose unreasonable burdens on farmers. Therefore, the government has intervened in various ways to reduce the association fees due from the farmers. Whereas it is probable that the intention underlying the 1906 ordinance was to establish associations that would require no government financial support, there has been an evolution toward an increasing level of government subsidies designed to limit irrigation fees to levels which farmers can reasonably afford to pay.

It is not clear from the early records, to what extent, if any, the government provided subsidies to the associations to cover the construction costs of the irrigation facilities. In any case, the fees of the irrigation associations were very high during the 1920s and 1930s. In the late 1920s the average fees were equivalent to about 600 kilograms (kg) of unmilled rice per hectare. According to yield estimates of the time, this was approximately 20 percent of the average gross production.[2] In terms of rice prices and wages, the fee per hectare was equivalent to the cost of about 125 man-days of labor (Annex 5). In 1930, the average fee rose to its highest level ever — over 900 kg of unmilled rice, or about 30 percent of gross production. This was a reflection of a very sharp drop in the farm price of unmilled rice — from 11.1 yen per 100 kg in 1929 to only 6.2 yen in 1930.

In the following year, the irrigation fee was lowered, and throughout most of the 1930s the average fees ranged between 440 and 560 kg of unmilled rice, or about 15 percent of the gross production, and about 100 man-days of labor (Annex 5). In comparison, the Japanese farmers in Hokkaido were paying less than half of this amount of unmilled rice as their irrigation fees during this same period (Korean Farm Association 1944:473).

It is likely that these high levels of fees represented the normal O&M costs plus most or all of the construction cost of the irrigation facilities, amortized over a modest period of time at commercial interest rates. In addition, about 10 percent of the fees were used to accumulate reserve funds which were required by the government.[3] When rice prices were high, as in the years between 1918 and 1926 (Annex 3), farmers were apparently able to pay these high fees, although no precise data on the rates of fee collection are available.

Beginning in 1926, rice prices declined continuously for six years, with a very sharp drop in 1930 and 1931, reflecting the world-wide depression (Annex 3). With this decline in rice prices, many farmers found it difficult to pay these high fees, in particular those who were farming reclaimed lands or lands with poor soil fertility. Rates of collection of the assessed fees dropped in many associations and unpaid fees accumulated.

An additional source of financial problems for the associations was related to the large number of farm bankruptcies and the difficulties that banks holding defaulted mortgages encountered in finding buyers for this land. As a result, part of the land served by the irrigation associations became idle, and therefore no longer subject to irrigation fees.

[2]It is possible that these yield figures were overestimated. In 1935, as part of an effort to ensure that assessments for irrigation fees were reasonable, the government adopted a new method of obtaining yield data.

[3]Reserve funds may be established for contingencies and emergencies, as well as for capital replacement. The development of reserve funds for irrigation associations is discussed briefly in the Appendix.

These financial problems created difficulties for the O&M of the irrigation facilities. The associations suffered from large deficits in their annual budgets though some associations managed to obtain short-term loans to cover these deficits. The deficits lasted, however, for many years.

By 1930, about 40 of the 177 irrigation associations were almost insolvent, and farmers voiced bitter criticism of the associations. The colonial government undertook emergency rescue measures to help the most hard-pressed associations. Low-interest loans were given to associations, and some of the debt which the associations owed to the government was written-off. These measures allowed the associations to lower their fees and still be able to meet their (now reduced) financial obligations.

In spite of these efforts, the financial problems persisted. In January 1935, the government prepared a plan to dispose of financially troubled irrigation associations. As a first step, the government took action to set the levels of association fees based on the actual farm production. For this purpose, a new survey method for obtaining yield data was established. Beginning in the late 1930s, the magnitude of association fees began to decline (Annex 5). Also about this time, the rice price was supported and rose. These changes made it easier for the associations to collect irrigation fees, and their financial situation improved. Many of the associations were able to cover their O&M costs and still save part of their income from water fees to build a reserve fund.

The confusion that swept the country following national liberation in 1945 affected the irrigation associations. Many association members complained about the staff and the operation of the associations under the period of Japanese rule. As a result, the staff and employees of the associations were shuffled. Association fees dropped to an average of only about 100 kg of unmilled rice/ha (less than one-third of the level prevailing in 1941). Even so, collection rates were poor.

The financial condition of the associations deteriorated between 1945 and 1951. As access to credit was very limited, it was often not possible for them to undertake the construction of new facilities. Furthermore, during the Korean War, many of the irrigation works were partly destroyed, and could not function properly until they could be rebuilt following the armistice in 1953. Many of the association members tried to use the confused conditions as an excuse for not paying their fees.

Another difficulty experienced by associations related to the fact that association fees were denominated and collected in cash. It became more difficult to collect the fees immediately after the rice harvest, when rice prices were generally low, as many farmers withheld each year's payment until the summer of the following year when they could get higher prices for their rice. This created cash-flow problems for the associations, frequently forcing them to borrow money from external sources.

In 1952, the government formulated new regulations regarding fee assessments and payments. Responsibility for setting the fee within each irrigation association was given to a Board of Operation consisting exclusively of farmers. Fees continued to be assessed in cash, but payment could be made either in cash or in unmilled rice valued at its market price at the time of the assessment. A 10 percent surcharge was added as a penalty to fees not paid by the due date. At the same time, the government imposed a ceiling on the fees that an association could charge. The ceiling varied with the quality of land, and with the yield level achieved by the farmer.

This imposition of a ceiling on irrigation fees was significant because the government recognized that in the absence of subsidies, the financial autonomy of irrigation associations might lead to fees which would be politically unacceptable. It was this recognition that ultimately led both to the establishment of systematic policies designed to provide subsidies to the associations, and to a variety of government actions and controls designed to keep the expenditures of the associations within acceptable limits.

The immediate concern, however, was less with reducing fees than with increasing them (and the rates of collection) to levels that would provide the funds needed for the operation of the associations. The average irrigation assessments, which had been equivalent to about 110 kg of unmilled rice during the years from 1945 to 1952 nearly doubled to 210 kg in 1953.

Beginning with the crop harvested in 1952, collection of fees in-kind was permitted. In that year, 277 associations elected to collect the irrigation fee in-kind, while the remaining 293 associations continued to collect it in cash. Data from the 277 associations collecting fees in-kind show an average collection rate of 83 percent of the assessments (Agricultural Development Corporation 1976).[4] These associations, however, found it difficult to dispose of the unmilled rice collected from farmers. Although the government had established a minimum price for purchasing rice, due to budget limitations it was unable to purchase most of the rice acquired by the irrigation associations. This required the associations to sell the rice on the private market. But following the 1952 harvest, the market price of rice declined continuously until the summer of 1953. As a result, the associations were unable to realize the expected amount of cash from the rice which they had collected as fees. A similar problem was encountered in 1953, when prices dropped from October through April of the following year.

By 1958, the government had been dissatisfied with the results of its experiment with having fees established by the farmer-controlled Boards of Operation of the irrigation associations. Although the average association fees had increased to 210 kg/ha in 1954, they had dropped back to 150 kg/ha by 1957. The government felt that the Boards of Operation, acting in response to farmers' pressures to keep fees low, tended to make unreasonably low estimates of the funds needed for O&M. Therefore, the government amended the process of assessing irrigation association fees in September 1958.

The new guidelines for fee assessments provided that: 1) annual installment payments for long-term loans and payments to a disaster rehabilitation fund should be taken into account in determining the amount of funds which an association needs to raise through fees in a given year; 2) before imposition, the association's proposed fee structure for a given year should be subject to approval by the provincial governor; 3) the government's rice-purchasing price, rather than the market price, should be used in converting the monetary amount of the fee into its equivalent value in rice; 4) reserve funds should be established for properly maintaining and operating the existing irrigation facilities and for expanding farm improvement projects; and 5) anyone paying association fees within a specified period should be granted a 10 percent discount.

The effect of the new guidelines is reflected in a doubling of the average assessments per hectare between 1957 and 1959 (Annex 6). The average rate of collection of the fees assessed, which stood at 71 percent in 1957, remained approximately constant in 1958 and 1959. Although average assessments declined

[4]Although data on fee collections for 1952 are not available from the 293 associations which continued to collect in cash, it is likely that the collection rate was much lower than for those associations which collected in-kind (unmilled rice).

again in 1960, rates of collection began to rise, reaching 92 percent by 1962. This, combined with a rising rice price, resulted in an increase in the total revenues collected from irrigation fees.

In order to maintain the high level of fee collection which had been achieved, the government felt that it must deal with the problem of unpaid fees from previous years. In 1963, the government provided special subsidies to the associations in the form of payments and write-offs of long-term loans to cover uncollectible water charges. These special subsidies totalled 1,973 million won (W). In effect, the government thus forgave a part of the principal and interest on loans which it had made to the associations for the construction of irrigation facilities.

During the period from 1966 to 1971, the government maintained the price of rice at a level favorable to agricultural producers. Increased income among farmers led them to pay their unpaid fees of previous years. Rates of collection of the assessed fees grew, reaching 96 percent in 1971. Since then, collection rates have remained around, or exceeded this level (Annex 6).

Data on the average irrigation charge imposed by the associations for the period 1966-1971 are not available. It seems probable, however, that the charges rose, because by 1972 the government was concerned about the high cost of the operations of the associations which it felt reflected inefficient management practices. In an effort to reduce the burden of fees on the farmers, the Law of Special Measures concerning the Fostering of Farmland Improvement Associations was passed in 1972. This law reduced the amount of irrigation fees required for the repayment of prior long-term loans which had been incurred to cover the capital costs of construction. In addition, the law specified a maximum limit on the proportion of total disbursements which could be used for operational expenses (30 percent) and a minimum limit on the proportion allocated for project expansion and maintenance (40 percent). This law also defined the direction in which the associations would develop, and itemized their functions in detail.

Irrigation fees, which averaged between 220 and 230 kg/ha during the early 1970s began to rise in the late 1970s, reaching over 400 kg/ha in 1982 (Annex 6). Concern about the high level of irrigation fees has been a recurring theme in recent years. Partly as a result of this concern, subsidies for capital costs of irrigation have become quite substantial. These subsidies are based on the nature and size of the facilities being constructed (Annex 7). For instance, 70 percent of the capital cost of a large reservoir project is provided by the government as subsidies. The benefited farmers need to cover the remaining 30 percent of project costs by means of installments for 30 years, at a subsidized interest rate. Small et al. (1986) estimated the effective subsidy on the capital cost of new irrigation projects to be over 90 percent.

In recent years, the concern over high irrigation fees has also led the Ministry of Agriculture and Fisheries to establish ceilings on the fees that can be charged by the FLIAs. These ceilings are established in terms of rice and translated into cash at the official government purchase price of rice. Reflecting the fact that the fees of all FLIAs have distinct components for O&M and for repayment of capital costs, separate ceilings have been set for each component. For the O&M component, the ceilings established are 250 kg of unmilled rice/ha for areas irrigated from reservoirs, 300 kg/ha for areas served by pumping stations, and 350 kg/ha for areas served by pumping and drainage stations. This generally acts as a limit on spending for O&M by the irrigation associations.

The ceiling on the component for capital repayment has been fixed at 200 kg of unmilled rice / ha since 1983. Whenever the charge for repayment, calculated on the basis of the normal subsidy, exceeds this amount, a special arrangement to limit the charge to the ceiling amount is triggered. The arrangement may be to extend the repayment period for the loan (which implies an additional subsidy, given the below-market rate of interest on the loan), or it may be to increase directly the nominal subsidy on the capital costs, thus decreasing the amount which is to be repaid by the farmers.

Another manifestation of the concern over high irrigation fees is the increased control which the Ministry of Agriculture and Fisheries has exerted over irrigation associations. For example, the Ministry has developed guidelines for the staffing pattern of individual associations which specify the number of divisions, sections, and staff members an association could have. These numbers vary according to the size of the service area of the association. A large association (25,000-35,000 ha) is permitted 4 divisions and 13 sections, and a small association (5,000-8,000 ha) is allowed 1 division and 5 sections. For the 73 percent of the FLIAs with service areas less than 5,000 ha, only 2 or 3 sections, such as General Affairs, Finance, and Maintenance are permitted. The number of divisions determines the number of staff members in an association, because there is a specified limit on the number of staff for each division. Through such guidelines the Ministry attempts to limit the operational expenditures of the associations.

Maintaining Financial Autonomy within a System of Government Subsidies

The concept of financial autonomy implies that irrigation associations obtain the bulk of their operating funds from fees assessed and collected from their members. If the associations were to have financial self-sufficiency (i.e., 100 percent financial autonomy), all of their funds would have to come from revenues which they earned. It seems likely that such financial self-sufficiency was anticipated at the time the Irrigation Ordinance was passed in 1906. As discussed earlier in this paper, however, over the years irrigation associations have faced repeated financial difficulties, and the government concluded that subsidies were necessary to keep irrigation fees at acceptable levels.

In providing subsidies, however, the government successfully avoided undermining the key elements of financial autonomy. In particular, government subsidies have been structured so that a direct link exists between an irrigation association's revenues from fees, and the amount of funds available to it for its operational budget. As a result, decisions on expenditures have direct implications for the required level of fees, and rates of fee collection have direct implications on the availability of funds to meet planned operational expenditures.

Financial assistance to irrigation associations began as early as 1935. In that year, the government reviewed the status of 68 associations which had particularly severe financial problems (Japanese Government General in Korea 1935:740-741). This led to the decision to abolish five associations because of their members' inability to meet the basic operating expenses. The outstanding debts of these associations were repaid by the government. Another 35 associations were judged to have the potential for better operation if adjustments could be made to relieve their financial burdens stemming from past loans. For these associations, the government provided assistance in the form of

refinancing arrangements that involved a reduction in the rate of interest to be paid on past government loans, and a lengthening of the period of amortization. In addition, a portion of the annual installments deemed to be beyond the farmers' ability to pay was refinanced by the government as a new loan. These associations, however, were obliged to repay the amount disbursed by the government within 20 years following the end of the 30 original annual installments. The government also assigned a number of managers to these associations to promote more effective management, and paid them subsidies to cover part of their salaries. The remaining 28 associations which were reviewed were judged to have had relatively effective operations, and financial assistance from the government was limited to an increase in the period of loan amortization.

This set of actions taken by the government in the 1930s to deal with the financial problems of irrigation associations can be interpreted as an effort to balance the need for government subsidies with the maintenance of financial autonomy. Where future financial autonomy did not seem likely, the association was abolished, and where it seemed possible, the government's financial assistance was designed more toward a restructuring of the financial arrangements so that the annual assessments on the farmers would be at a reasonable level. Furthermore, the government's financial assistance was accompanied by measures designed to improve the efficiency of management of the associations to ensure the future viability of financial autonomy.

In the period immediately following World War II, many associations faced financial difficulties. Small subsidies and loans were provided as relief to some associations during the period of the US military government (August 1945-August 1948).

Another special financial intervention by the government took place in 1963. Following a period of restructuring of the irrigation associations that involved increased government control (particularly through its powers to appoint key officials) and sharply improved rates of fee collection, the government provided a special subsidy payment to cover uncollectible water charges. These payments totaled W 1,914 million (Agricultural Development Corporation 1976). In effect, the government forgave a part of the principal and interest on loans which it had made to the associations for the construction of irrigation facilities.

Although the financial intervention by the government at this juncture could be interpreted as tending to break the link between an association's expenditures and the revenues it obtains from members' fees, it needs to be evaluated within the special context in which it occurred. This intervention took place only after successful implementation of measures designed to enhance the financial strength of the associations while retaining their financial autonomy. The ensuing result was an increase in the average rate of fee collection to over 90 percent. By removing financial burdens built up over the previous years when the associations had been less successful in collecting fees, the government ensured that the improvements could be sustained.

During the 1970s, the government encouraged the construction of new and more complex irrigation facilities. It became apparent, however, that the associations would need both financial and technical assistance for such construction. Therefore cost-sharing arrangements were developed to provide for government subsidies of varying proportions (Annex 7). Although these subsidies were large, the

specific amounts were determined on the basis of the size and type of facilities built, and not by the financial condition of the FLIA. This enabled the key features of financial autonomy to be retained. Despite large government subsidies for the cost of construction of irrigation facilities, the FLIAs retained "financial autonomy" as they were responsible for funding their own budgets through member fees. With very few exceptions, any increase in expenditures had to be met from an increase in the association's own revenues.

CONCLUSIONS

Korea's irrigation associations are characterized by financial autonomy within a framework of government subsidies, strong indirect control and supervision by the central government, and low levels of direct farmer involvement. These features — particularly the first two — can be traced back to the beginning of modern irrigation development in Korea in the early 1900s.

The concept of financial autonomy was a key institutional feature of Korea's first modern irrigation ordinance, established by the Japanese Government in 1906. Korean irrigation development was thus modeled on the Japanese experience, and incorporated a long tradition of financial autonomy.

Financial autonomy appears to be a key element underlying Korea's current success with irrigation financing, despite financial difficulties dominating much of the history of Korean irrigation associations. The success of financial autonomy in Korean irrigation results both from Korea's history of irrigation development, with its origins in Japanese institutions, and from a consistent commitment to addressing financial problems retaining financial autonomy as a primary view.

Some of the financial problems of irrigation associations are brought forth by the high cost of irrigation. At various times, farmers have been either unwilling or unable to pay the full amount of these costs. Particularly since independence from Japan, the government has also been concerned with the burden which irrigation fees place on the farmers. Consequently, a system of government subsidies has evolved to ease the burden of irrigation fees while still preserving the basic concept of financial autonomy.

The feature of government control and supervision of irrigation associations was also an element of the original irrigation ordinance, and appears to have continued throughout the period of Japanese rule. With independence, the extent of central government control over irrigation associations was reduced. From 1945, associations were permitted to elect their own heads, and by 1952 farmer-controlled Boards of Operation had the power to establish the level of irrigation fees. But by the late 1950s, the government began to reestablish strong control over the associations. In 1958 the government established guidelines that constrained the powers of the Boards of Operation to set irrigation fees. The power to appoint the heads and councils of the associations was withdrawn from the associations in 1961. In the same year, the government integrated 695 associations into 198. Over the past 25 years, direct and indirect government subsidies to the associations have increased, further strengthening the rationale for government control over their activities. This control, through appointment of association heads, and through financial and operational regulations and guidelines has remained strong until now.

One recurring issue in the history of Korean irrigation associations, owing to financial problems, has been the degree of decentralization. Small independent associations, which could serve only a small area, were seen as costly, as the administrative overhead costs were high. At several points in time notably in the 1930s, in the period of the late 1950s through 1961, in the early 1970s and again in 1980 — associations were merged both to create the perceived economies of scale associated with management, and to allow financially stronger associations to carry the burdens of the financially weaker associations. Thus, primarily because of financial considerations, irrigation associations have, over time, become more centralized.

The increasing centralization of irrigation associations has meant that individual farmers are further removed from the managers of associations. This is reflected in the limited involvement of farmers in the operation of the associations. Limited involvement of farmers and largeness of associations have created communication problems between farmers and association managers. The government has attempted to deal with these problems by encouraging the development of a system of key farmers, whereby one farmer in each village serves as the key communication link between the associations and the rest of the farmers.

The rates of fee collection in Korean irrigation associations today are very high (virtually 100 percent). The legal basis for the fees is equivalent to that for the land tax, and this is undoubtedly important in achieving high rates of collection. But viewed in an historical perspective, achieving high rates of fee collection appears to have long been a problem. Efforts have been made to improve the fee-collection rates at various times. The last, and perhaps most successful of these efforts, appears to have been made in the early 1960s, when fee-collection rates were raised above 90 percent. The specific factors underlying this success are not clear, but it is likely that they relate to the significantly increased degree of central government control in 1961. It would be instructive to investigate further into the specific incentives and sanctions which were used, both at farmer and association level, to achieve this result. Unfortunately, data on collection rates prior to 1957 (when collection-fee rate was about 70 percent — a rate which is high relative to those achieved even today in many other Asian countries) are unavailable, at least at a central level, making it difficult to assess the progress of fee-collection rate increases and the factors underlying it. Perhaps future research at individual association level will be able to shed additional light on this important question.

APPENDIX

FINANCING OF RESERVE FUNDS

Annual operating expenses of FLIAs are met in principal by their annual revenues — the bulk of which come from the annual irrigation fees collected from their members — because they are nonprofit public juridical entities. In this sense, there is no need to accumulate property as private juridical entities do. However, because irrigation facilities deteriorate over time, and inevitably will need substantial repair or replacement, there is a need to accumulate a reserve of funds for capital replacement.

Other financial contingencies may also occur. Natural disasters can lead to unexpected expenses, and poor harvests may cause revenues to drop sharply in some years. To be able to meet these financial contingencies, the government has sought to have the associations build a system of reserve funds. The purpose of accumulating reserve funds is thus to meet special objectives associated with the long-run maintenance of the physical and financial viability of the assets of the association.

A system of reserve funds was first established during the period of Japanese rule. Associations were forced to establish their fees at levels which allowed approximately 10 percent of revenues to be used to build a reserve fund to create a solid financial base for the associations. During these years, irrigation association fees were at very high levels.

Reserve funds were not maintained during the first 15 years following national liberation. The post-liberation paralysis of the management of associations, and the rapid depreciation of the Won during a period of strong inflation had a negative influence on the reserve system. Beginning in 1961, the government placed increased emphasis on the development of a system of reserve funds, and the associations once again began to accumulate reserves.

By the end of 1973, reserve funds of all irrigation associations totaled W 1,120 million, which was equivalent to 16 percent of their total assessments for irrigation fees in that year. This average figure then dropped slightly, but has remained at approximately 14 percent since 1974. Not all individual associations have been able to develop a satisfactory level of reserves, however. It is generally the large associations which have been able to generate a relatively high level of reserves.

Current government regulations require that reserve funds be held in a special account. Unless needed by the association for some purpose, the funds are deposited with the Federation of National

Farmland Improvement Associations (FNFLIA). The FNFLIA is allowed to loan these funds to associations with inadequate reserves. Through this mechanism it is thus possible for one association to effectively borrow the reserve funds of another. Reserve funds are to be used for specific purposes and they cannot be borrowed, even temporarily, for most other purposes. Associations are, however, permitted to borrow these funds to meet seasonal shortages of working capital. In such cases, repayment must be made within the same year.

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Annex 1. Ordinance of irrigation associations (Ministry of Finance Account Number 3, 26 March 1906)

Article 1 Irrigation Associations shall be established to engage in projects related to the irrigation, draining, reclamation or conservation of lands.

Article 2 In order to carry out their projects, associations shall have as their areas those lands where their projects can generate profits. The persons residing in such areas shall be the members of associations.

Article 3 The establishment of an association shall be subject to approval of the Minister of Finance.

Article 4 Associations shall be managed subject to control and supervision of a person designated by the Minister of Finance or the Minister of Agriculture.

Article 5 The expenses of associations shall be shouldered by association members according to the acreage and grade of their lands.

Article 6 Associations may impose on their members such assessments for labor, goods and / or land as necessary for the implementation of their projects.

Article 7 When an association plans to conduct an appraisal required for the assessment prescribed in Article 5 and make the imposition prescribed in Article 6, it should obtain an approval of the Minister of Finance beforehand.

Article 8 Collection of association fees and action against delinquents shall be in accordance with the method of collecting national taxes.

Article 9 Associations should make deposits in amounts determined by the Minister of Finance.

Article 10 Associations cannot incur debts without the approval of the Minister of Finance.

Article 11 Managers should prepare budgets and settlement for reporting to the Minister of Finance. The Minister of Finance shall make them public to the associations.

Article 12 The government may guarantee the payment of the principal and interest of debts incurred by associations.

Article 13 Regulations on public officials shall be applied *mutatis mutandis* to the managers of associations and other persons engaged in the clerical works of the associations.

Source: Japanese Government General in Korea (1914:219).

Annex 2. Number and average size of irrigation associations in Korea[a], 1908 - 1984.

Year	Number of associations	Benefited area (ha)	
		Total	Average per association
1908	4	4301	1075
1909	6	7980	1330
1910	6	7980	1330
1911	7	10766	1538
1912	8	12763	1595
1913	b	b	b
1914	7	16094	2299
1915	7	16621	2374
1916	9	22751	2528
1917	12	24747	2062
1918	12	24747	2062
1919	15	40863	2724
1920	25	43379	1735
1921	37	49889	1348
1922	49	67787	1383
1923	54	78020	1445
1924	60	84072	1401
1925	72	112934	1569
1926	90	136059	1512
1927	107	145638	1361
1928	126	178806	1419
1929	149	206016	1383
1930	177	217335	1228
1931	193	223577	1158
1932	194	225349	1161
1933	196	226793	1157
1934	192	226052	1177
1935	192	229512	1195
1936	190	227913	1200
1937	190	229035	1205
1938	189	230184	1218
1939	245	236192	964
1940	300	252727	842
1941	373	294192	789
1942	432	305527	707
1943	483	321544	666
1944	595	349498	587
1945	598	356678	596
1945-South	425	188167	443
1945-North	173	168511	974
1946	438	206762	472
1947	440	208762	474
1948	440	213594	485
1949	458	224399	490
1950	442	195656	443

(Continued on page 137)

(Annex 2, continued)

Year	Number of associations	Benefited area (ha)	
		Total	Average per association
1951	489	211777	433
1952	570	262333	460
1953	587	273175	465
1954	596	284073	477
1955	668	312396	468
1956	[b]	[b]	[b]
1957	683	325045	476
1958	690	330618	479
1959	699	334605	479
1960	695	334578	481
1961	198	341227	1723
1962	198	343730	1736
1963	198	346058	1748
1964	199	347775	1748
1965	222	353211	1591
1966	266	377445	1419
1967	272	387290	1424
1968	272	392800	1444
1969	269	402348	1496
1970	266	406474	1528
1971	268	318597	1189
1972	266	327250	1230
1973	127	333699	2628
1974	127	339591	2674
1975	126	358838	2848
1976	127	373120	2938
1977	123	391675	3184
1978	122	409656	3358
1979	123	413763	3364
1980	123	419910	3414
1981	103	420952	4087
1982	103	432980	4204
1983	103	445035	4321
1984	103	453059	4399
1985	103	462223	4488

[a]Figures from 1908 to 1945 are for all of Korea, before it was divided into North and South in August 1945; figures subsequent to 1945 are for the Republic of Korea.

[b]No data available.

Sources: 1908-1945: Union of National Irrigation Associations (1956:92-93,366). 1945-1965: Union of National Irrigation Associations (1967:402-403). 1966-1985: Ministry of Agriculture and Fisheries, 1967, 1971, 1978, 1985, and 1986.

Annex 3. Rice prices and farm wage rates.

Year	Average wholesale price of milled rice[a]	Farm wage rate[b]	"Real rice price" (wholesale rice price deflated by farm wage rate)[c]
1915	80		
1916	96		
1917	107		
1918	167		
1919	285		
1920	397		
1921	182		
1922	252		
1923	186		
1924	273	0.35	780
1925	295	0.41	720
1926	269	0.88	306
1927	245	0.76	322
1928	210	0.76	276
1929	210	0.77	273
1930	181	0.73	248
1931	121	0.58	209
1932	153	0.55	278
1933	152	0.56	271
1934	175	0.61	287
1935	213	0.65	328
1936			
1937			
1938			
1945	20		
1946	50		
1947	80		
1948	110		
1949	120		
1950	320		
1951	1610		
1952	5830		
1953	6060		
1954	4920		
1955	11830		
1956	18570		
1957	19930		
1958	16420		
1959	14500	97.0	149
1960	17140	96.0	179
1961	21130	106.0	199
1962	22150	115.0	193
1963	35090	143.0	245

(Continued on page 139)

(Annex 3, continued)

Year	Average wholesale price of milled rice[a]	Farm wage rate[b]	"Real rice price" (wholesale rice price deflated by farm wage rate)[c]
1964	43470	199.0	218
1965	41640	221.0	188
1966	42740	256	167
1967	46880	307	153
1968	53610	381	141
1969	64250	463	139
1970	72300	579	125
1971	89410	695	129
1972	123050	803	153
1973	121600	886	137
1974	152190	1141	133
1975	247510	1467	169
1976	277940	1903	146
1977	302450	2350	129
1978	352450	3393	104
1979	469440	5140	91
1980	595790	6509	92
1981	742300	7388	100
1982	758680	8163	93
1983	764550	8656	88
1984	768100	9134	84
1985	830020	9695	86
1986	898930	10142	89

[a]From 1915-1935, prices are in *yen* per metric ton; from 1945-1980, prices are in *Won* per metric ton, rounded to the nearest 10 won.

[b]From 1924-1935, farm wage rates are in *yen* per day; from 1959-1979 they are in *Won* per day.

[c]These figures represent the number of man-days needed to buy 1 ton of milled rice.

Sources: 1915-1978: Rose, Beth (1985, Tables 4 and 6). 1979-1986: National Agricultural Cooperative Federation (1986).

Annex 4. Number and potential development area of irrigation associations in the Republic of Korea, August 1945, by size of association and by province.

Province	Size of association's potential development area (ha)							
	Less than 300		300-2000		More than 2000		Total	
	No.	Area	No.	Area	No.	Area	No.	Area
Kyonggi	22	3273	7	4044	2	6130	31	13457
Chungbuk	25	3648	3	2777	-	-	28	6424
Chungnam	37	5576	9	6069	2	11341	48	22986
Jeunbuk	44	5012	2	817	2	41846	48	47675
Jeunnam	109	14848	11	6810	1	2600	121	24258
Kyongbuk	47	7189	11	8737	-	-	58	15925
Kyongnam	54	5831	17	16207	2	4662	73	26700
Kangwon	5	344	1	578	-	-	6	922
Whanghae	7	1143	4	4081	1	24596	12	29820
Total	350	46862	65	50120	10	91184	425	188167

Source: Union of National Irrigation Associations (1956:96-97).

Annex 5. Average irrigation fees relative to production and rural wages, Korea, 1927-1941.

Year	Total area on which irrigation fees were assessed (ha)	Average irrigated yield (kg rice per ha)	Average water charge (kg rice per ha)	Water charge as a percent of yield	Water charge per ha, man-day equivalents[a]
1927	[b]	2920	590	20.2	137
1928	[b]	2770	620	22.4	123
1929	[b]	3150	600	19.0	118
1930	[b]	3120	910	29.2	162
1931	162672	2740	560	20.4	84
1932	178078	3070	610	19.9	122
1933	192397	3010	560	18.6	109
1934	189075	3070	440	14.3	91
1935	205038	3410	450	13.2	106
1936	203847	2970	440	14.8	[b]
1937	214691	3580	530	14.8	[b]
1938	215624	3370	460	13.6	[b]
1939	190652	3270	350	10.7	[b]
1940	217894	3200	330	10.3	[b]
1941	[b]	3310	350	10.6	[b]
Average		3131	520	16.6	

[a]Based on data on rice prices and rural wage rates in Annex 3, and a milling recovery rate of 0.72.

[b]No data available.

Source: Union of National Irrigation Association (1967:236).

Annex 6. Assessments and collection of water charges in the Republic of Korea by year, 1952-1985.

Year	Number of associations[a]	Total area on which fees were assessed ('000 ha)	Total amount of fees assessed (million Won)	Fees collected		Average assessment (kg/ha)[c]	Average irrigation fees as % of average yield	Water charge per ha, man-day equivalents[d]
				Total (million won)[b]	% of amount assessed			
1952	293	148.4	42	n.a.	-	110	4.0	-
1953	321	163.2	54	n.a.	-	110	3.8	-
1954	346	156.4	111	n.a.	-	210	7.1	-
1955	324	162.7	265	n.a.	-	210	6.8	
1956	-	-	-	-	-	-	-	-
1957	444	194.7	414	293.2	70.8	150	4.6	
1958	483	205.6	567	409.4	72.2	240	6.6	
1959	487	212.5	639	444.3	69.6	300	8.6	32
1960	526	242.6	634	507.1	80.0	220	6.1	28
1961	188	246.7	815	694.1	85.1	220	5.7	32
1962	194	268.8	993	918.6	92.5	240	6.9	33
1963	196	274.9	1210	1113.8	92.0	180	4.6	32
1964	197	279.6	1451	1364.2	74.0	170	4.1	27
1965	219	278.7	1861	1752.8	94.2	220	4.7	30
1966	266	281.6	2226	-	-			
1967	272	284.1	2466	-	-			
1968	269	274.5	2820	-	-			
1969	269	292.5	3605	-	-			
1970	266	296.3	4485	4253	94.8			
1971	268	310.1	5776	5561	96.3	-		
1972	266	304.6	6255	5934	94.9	235	-	26
1973	127	316.6	7169	6982	97.4	231	6.0	23
1974	127	320.7	9935	9806	98.7	225	5.8	22
1975	126	325.6	12680	12543	98.9	222	5.4	27
1976	127	348.9	16927	16794	99.2	232	5.0	24
1977	123	379.2	22937	22744	99.2	258	5.1	24
1978	122	374.9	27152	26669	98.2	340	5.1	25
1979	123	400.0	39938	39376	98.6	303	6.5	
1980	123	361.9	42775	42124	98.5	358	9.8	
1981	103	413.4	59910	59044	98.6	317	7.0	
1982	103	421.3	64210	63388	98.7	409	8.6	
1983	103	433.4	67735	66556	98.3	310	6.6	
1984	103	433.3	68478	67212	98.2	313	6.7	
1985	103	442.5	73205	71981	98.3	301	6.4	

[a]This is the number of associations for which data on collections are available.

[b]Fees collected in-kind were converted into their equivalent monetary value.

[c]Figures are in terms of unmilled rice. For 1971-1984, the figures have been converted from data on cash value.

[d]Based on data on rice prices and rural wage rates in Annex 3. A milling recovery ratio of 0.72 has been used to convert from unmilled rice to milled rice.

Sources: 1945-1965: Union of National Farm Land Development Associations (1967:419, 242, 245, 238). 1966-1984: Ministry of Agriculture and Fisheries(1972:374-375, 1978:504-505, and 1986:330-333).

Annex 7. Cost sharing formulae for the capital costs of irrigation projects in the Republic of Korea, by size and type of project, 1985. (% of capital cost).

Size of project	Type of investment	Direct subsidy			Nominal cost to farmers		
		Central govt.	Local govt.	Total	Financed with long-term loan	Financed with short-term loan	Total
Large	Reservoir	70	-	70	30	-	30
	Pumping Station	85	-	85	15	-	15
Medium	Reservoir	70	-	70	30	-	30
	Pumping Station	85	-	85	15	-	15
Small	Reservoir	70	20	90	-	10	10
	Pumping	70	20	90	-	10	10
	Weir	70	20	90	-	10	10
Tidal-land reclamation		80	-	80	20	-	20
Land consolidation	Large-scale	50	20	80	-	20	20
	Medium-scale	60	20	80	13.3	6.7	20
Land reclamation		60	-	60	40	-	40
Reclamation converting upland		50	-	50	30	20	50

Source: Agricultural Development Corporation 1985.

Financing Irrigation Services in Nepal

Edward D. Martin, Prachanda Pradhan, and S. Adriano

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

[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

[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 per hectare. This has been controversial because in most of

[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 agricultural 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 net income/ha
	Rice	Wheat	Total	Rice	
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

[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.

[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

(Continued on page 176)

[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.

[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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Financing Irrigation Services in the Philippines

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FINANCING IRRIGATION SERVICES IN THE PHILIPPINES

INTRODUCTION

Types of Irrigation

Irrigation in the Philippines is generally categorized into three types of systems: national (gravity) irrigation systems, communal irrigation systems, and pump irrigation systems. In 1984, about half of the total irrigated area of 1.4 million hectares (ha) was in communal irrigation systems, 40 percent in national irrigation systems, and 10 percent in pump irrigation systems (Table 5.1).

Table 5.1. Irrigation development, 1972-1984.

Type of irrigation system	1972		1984		Percent increase
	ha	percent	ha	percent	
National	379205	51.1	559447	39.7	48
Communal	293819	39.6	696751	49.5	137
Pump	69423	9.3	152128	10.8	119
Total	742447	100.0	1408326	100.0	90

Irrigation development between 1972 and 1984 has been rapid, with a 90 percent increase in the total area irrigated. The rate of increase was highest for communal irrigation systems and lowest for national irrigation systems. The area under pump irrigation increased by nearly 120 percent over the same period; however, the area under pump irrigation is relatively small, comprising about 10 percent of the total area irrigated. The increase in the proportion of irrigated land served by communal irrigation systems is a reflection of the emphasis the government has placed on the development and rehabilitation of these systems during the past decade.

Irrigation in the Philippine Development Plan

The updated Philippine Development Plan, 1984-1987, targets for the plan period the generation of an additional irrigated area of about 192,000 ha and the rehabilitation of existing irrigation systems covering 138,000 ha. This represents an increase of about 14 percent in the total irrigated area, and the rehabilitation of about 10 percent of the total irrigated area, or about 19 percent of the area irrigated by national irrigation systems and pump irrigation systems.

Investment requirements for water resources (including irrigation, water supply, flood control, drainage, and shore protection) amount to 25 percent of the entire infrastructure program of P75,445 million.[1] Irrigation accounts for about 48 percent of the budget for water resources, or 12 percent of the total infrastructure investment program. The infrastructure program investment requirements for 1983=1987 are given in Table 5.2.

Table 5.2. Infrastructure program investment requirements, 1983, 1984-1987[a] (in million pesos at 1984 prices).

	Actual	Requirements				1984-1987	
	1983	1984	1985	1986	1987	Total	Percent of total
Power and electrification	11938	7962	8193	6121	8114	30390	40
Power	11029	7046	7547	5059	6522	26174	
Electrification	909	916	646	1062	1592	4216	
Transport	5924	5920	4612	4269	4727	19527	26
Highways	3644	3542	2894	3159	3439	12943	
Railways	1737	1192	610	245	284	2330	
Ports	462	961	956	760	896	3573	
Airports and airways	81	315	151	105	108	680	
Water resources	3957	3775	4995	4503	5837	19110	25
Irrigation	1777	1704	2629	2611	2259	9203	
Water supply	1706	1798	2133	1656	3330	8917	
Flood control, drainage, and shore-protection	474	273	233	236	248	976	
Social/related infrastructure	1216	1514	1029	1186	1319	5048	7
School buildings	760	1206	715	808	918	3647	
Health facilities	266	180	184	209	225	797	
Urban infrastructure	101	116	125	154	158	553	
National buildings	89	12	5	15	18	50	
Communications	420	251	203	284	485	1223	2
Telecommunications	386	230	187	259	460	1135	
Postal communications	34	21	16	25	25	86	
Others	16	30	21	49	47	147	< 1
Total	23471	19452	19052	16412	20529	75445	100

[a] 1983 figures are actual, using the average exchange rate of P11.11 = US$1; 1984 figures are based on the average exchange rate of P16 = US$1; 1985-1987 figures are at mid-1984 prices assuming a constant exchange rate of P18 = US$1. Includes the requirements of MPWH, MOTC, MLG, MAR, MHS, MOH, MECS, NTC, NPC, NEA, NIA, FSDC, MWSS, LWUA, RWDC, PNR, LRTA, PPA, MIAA, State Colleges, and Universities.

Data as of 29 August 1984.

Sources: Subcommittees on Infrastructure and Energy on the Plan Updating (1984-1987), the Office of Budgetary Management and the National Economic and Development Authority.

[1] The conversion rate for pesos decreased from US$1 = ₱11.11 in 1983 to US$1 = ₱20.80 in 1987.

The updated irrigation program seeks to increase rice yields to sustain self-sufficiency and reduce regional deficits in this crop, expand irrigation to other crops in order to improve exports, and produce substitutes for imported agro-based products. The program also aims to raise farm incomes quickly, especially in the less developed areas. Increased participation of the farmer beneficiaries and local governments in planning, cost-sharing, implementation, and operation and maintenance (O&M) is also a program goal.

Given the increase in the costs of new projects, the plan proposes to achieve the above objectives by placing greater emphasis on the rehabilitation and improvement of existing irrigation systems, and on improved water management and systems operation. Emphasis is also placed on small-scale communal irrigation systems, which, because they are operated and maintained by farmers' associations, have less effects on the operating costs of the National Irrigation Administration. Construction of new pump irrigation systems is minimized in the plan, as expensive oil is needed for operation of such systems.

Irrigation Institutions

National Irrigation Administration (NIA). NIA was established in 1964 under Republic Act No. 3601, with responsibilities for the investigation, construction, improvement, and operation of all national irrigation systems in the country. Additional responsibilities related to flood control, drainage, land reclamation, hydraulic power development, domestic water supply, road or highway construction, reforestation, and projects to maintain ecological balance were given to NIA under Presidential Decree No. 552 of 1974. NIA also assists in the design and construction of communal irrigation systems, under arrangement with farmers' organizations that provide for the repayment of a portion of the capital cost incurred by NIA, and for the O&M of the completed facilities by the farmers' organizations.

NIA is a government corporation governed by a board of directors that includes the Minister of Public Works, the Administrator of NIA, the Minister of Agriculture, the Minister of Economic Planning, and the General Manager of the National Power Corporation. The NIA Administrator is appointed by the President of the Philippines. As a government corporation, it has the authority to collect water charges from the beneficiaries of the irrigation services it provides.

NIA maintains a central office and 12 regional offices. Each regional office is composed of six divisions (Engineering, Operations, Agricultural Coordination, Equipment Management, Administration, and Accounting). The Engineering Division is responsible for system construction activities while the Operations Division is responsible for O&M. At the irrigation project level, an irrigation superintendent is responsible for normal O&M activities, assisted by a staff of water masters, ditchtenders, and gatekeepers.

National Water Resources Council. The National Water Resources Council is responsible for formulating regulations for the use and management of water resources, and for coordinating water

development activities (irrigation, domestic water use, and industrial water use). Among its activities, it registers and issues water permits for the use of water for various purposes, including irrigation. The Administrator of NIA is a member of this council.

Farm Systems Development Corporation. The Farm Systems Development Corporation was created in 1975 with responsibility for organizing farmers into irrigation associations in communal irrigation systems that had been constructed by NIA, and where irrigation pumps had been sold to groups of farmers on government loans. Beginning in 1976, this corporation collected, for NIA, repayments made by irrigation associations of loans received for the construction of irrigation facilities. In general, the Farm Systems Development Corporation is responsible for small irrigation systems (less than 100 ha), and also for a number of activities that are unrelated to irrigation.

GENERAL POLICIES REGARDING IRRIGATION FINANCING

As a government corporation, NIA is the agency through which funds for irrigation development and operation are channeled. These funds come in the form of foreign and international loans and grants; capital stock subscriptions of the government; annual appropriations from the General Appropriation Act for communal irrigation development; and revenues earned by NIA for its services, which include water charges from irrigation beneficiaries, and a charge of five percent from loan funds for administrative and overhead costs associated with the supervision of construction of systems (Cruz, Siy, and Cruz 1985).

National policy on the repayment of the costs of irrigation facilities is embodied in the National Economic and Development Authority Resolution No. 20, Series of 1978. The resolution allows NIA to "impose charges to generate revenues sufficient to cover only O&M costs of such facilities and to recover within a period not longer than 50 years, the monies initially invested in such facilities; provided that such charges shall not impair the user's incentive to avail of the benefits from irrigation and provided further, that such charges are within the beneficiaries' capacity to pay." The resolution stipulates further that "the Government shall bear the cost of interest on all indebtedness incurred for the development of irrigation facilities particularly those for areas devoted to the production of rice, corn and feed grains, and vegetables." This policy for cost recovery also applies to communal irrigation systems constructed by NIA.

In recent years, financial pressures at the national level have resulted in reductions in the levels of government financial support for NIA (National Irrigation Administration 1984b). As a result, NIA has sought ways to increase its internally generated revenues and to reduce its operating costs. These efforts are reflected in the development of new procedures to improve irrigation fee collection: the conversion of marginal irrigation systems (those that generate revenues less than O&M costs) into communal irrigation systems which will be operated by farmers' associations; the transfer to farmers' associations of entire large irrigation systems (on a modular basis, by sections or laterals); and improvement of water delivery and services to farmers to enhance their willingness to pay for these irrigation services.

CAPITAL COST OF IRRIGATION

There is wide variation in the development cost per hectare among irrigation systems. Table 5.3 gives some indication of this variation with data on six foreign-assisted projects. Projects completed after 1980 have higher costs per hectare. The lower cost of Upper Pampanga River Project, Angat-Magat Irrigation and Development Project, and Aurora-Penaranda Irrigation Project may be attributed to their being implemented earlier and to the lower cost of rehabilitation, compared with new construction.

Table 5.3. Construction cost of completed foreign-assisted projects.

Project	Actual implementation schedule	Actual project cost (US$ million)			Service area (ha)			Development cost/ha
		Local	Foreign	Total	New	Rehab.	Total	
Upper Pampanga River Project	1970 - 1978	92.55	34.00	126.55	35152	47317	82469	1534.52
Angat-Magat Irrigation and Development Project	1973 - 1978	29.69	7.96	37.65	3810	670788	70888	531.12
Aurora-Penaranda Irrigation Project	1973 - 1981	38.70	18.94	57.64	8600	16700	25300	2278.26
Davao I Irrigation Project	1974 - 1980	11.80	4.20	16.00	8590	-	8590	1862.63
Libmanan-Cabusao Irrigation and Development Projects	1975 - 1981	10.72	0.42	11.14	3873	-	3873	2876.32
Pulangui Irrigation Project	1975 - 1982	15.94	12.80	28.74	12000	-	12000	2395.00

Note: Conversion rate for Upper Pampanga River Project is US$1 = P6.645, Angat-Magat Irrigation and Development Project US$1 = P6.75, Aurora-Penaranda Irrigation Project US$1 = P7.87, Davao I US$1 = P7.50, and Pulangui US$1 = P7.66.

Sources: National Irrigation Administration, CORPLAN (1984).

Moya (1985) estimated the capital cost of 12 irrigation projects in the Central Luzon region of the Philippines. The estimates, converted to 1984 prices, were about US$590/ha for one 2,700-hectare national irrigation system, US$155-910/ha for communal (village) irrigation systems, US$300-750/ha for surface pump irrigation systems, and US$1,660-2,430/ha for deep well pumping systems (Table 5.4).

In another study, Sison and Guino (1984) estimated the total capital cost of irrigation systems by type (national, communal, and pump irrigation systems) and size. Their findings, converted to 1984 prices, are summarized in Table 5.5. For national irrigation systems, the average costs per hectare for the systems studied were about US$700 for the large systems and about US$1,200 for the small systems. The capital costs of communal irrigation systems were about US$260/ha for the large

Table 5.4. Summary of costs per hectare of service area for 12 irrigation systems, Central Luzon, 1979-1980 wet and dry seasons.

Systems	Capital investment cost (US$/ha)		Annual operation and maintenance cost (US$/ha)		(US$/ha)	P/ha	Annualized total cost (US$/ha)	
	1980 prices	1984 prices	1980 prices	1980 prices	1984 prices	1984 prices	1980 prices	1984 prices
National system								
1. San Fabian	580	594	28	239	29	478	99	101
Village systems								
2. Prenza	885	906	10	85	10	170	117	120
3. Salapungan	502	514	6	51	6	102	66	68
4. Caingin	151	155	59	504	60	1008	77	79
5. Sibul	201	206	4	34	4	68	28	29
Surface pumps								
6. Buenavista	704	721	111	948	114	1897	197	202
7. Safari	297	304	54	461	55	922	94	96
8. Halina	508	520	175	1494	179	2989	248	254
9. Small pumps	729	746	56	478	57	956	197	202
Deep well pumps								
10. GP-3	2377	2433	146	1247	149	2495	425	435
11. GP-4	1625	1663	144	1230	147	2461	329	337
12. GP-19	2028	2076	176	1503	180	3007	421	431

Notes: Cost data are based on 12 percent interest rate and lifetimes of 60, 30, and 15 years for dams, canals, and pumps and engines, respectively. 1980 prices. Currency conversion rate is P 8.54 = US$1. 1980 prices converted to 1984 using Implicit GDP Deflator (Asian Development Bank 1985).

Source: Moya (1985).

systems, and US$590 for the small ones. Deep tube wells were estimated to cost about US$1,510/ha, and shallow wells about US$770/ha. These figures are roughly consistent with the estimates from the Moya study presented in Table 5.4.

OPERATION AND MAINTENANCE COST

Budgetary Procedures for the Provision of O&M Funds

Each February or March, the National Irrigation Administration's annual budget proposal for the following calendar year is prepared by the Management Services Department of its Programming Division. The proposed budget is submitted to the Office of Budget and Management before the end of March, in accordance with a time schedule established in a memorandum circular from this office.

Table 5.5. Average capital investment costs per hectare for different types and sizes of pirrigation systems in selected areas.

Size of system	Type of system								
	National			Communal			Pump		
	Number of systems[a]	Average service area(ha)	Average cost[b] (US$/ha)	Number of systems[a]	Average service area(ha)	Average cost[b] (US$/ha)	Number of systems[a]	Average service area(ha)	Average cost[b] (US$/ha)
Large	9	7416	708	15	275	264			
Medium	6	2228	1088	9	89	521	9[c]	58	1512
Small	5	515	1216	7	34	591	18[d]	3	766

[a]Number of systems included in the study.

[b]1984 prices. 1982 prices in pesos converted to 1984 prices using Implicit GDP Deflator and converted at P16.69 = US$1.

[c]Deep tube well systems.

[d]Shallow pump systems.

Source: Sison and Guino (1984).

The office evaluates the proposal, and by June or July calls for a budget consultation, attended by all the heads or representatives of the government corporations and presided over by the Prime Minister. At this budget consultation, the office gives each corporation its budget ceiling, based on the projected income of the national government. These ceilings are usually very much lower than the original budget proposal.

NIA's Programming Division then coordinates and consults with project managers and with NIA's Construction Management for the necessary revision of the budget. The revised budget is submitted to the Appropriations Committee of the *Batasang Pambansa* (National Assembly) in July, with a copy to the Office of Budget and Management. Discussions and debate on the budget are held in the National Assembly some time in August. The Assembly usually approves the budget late in August.

Expenditures for O&M

National irrigation systems. Aggregate data on O&M costs for national irrigation systems for 1979-1984 are presented in Table 5.6. Nominal O&M releases per hectare have been increasing except in 1983, when there was a 14 percent reduction from the previous year. In real terms, however, the funds available for O&M per hectare of service area have declined from 1981. In 1984 prices, O&M funding averaged about P355/ha for the years 1979-1981, which is about 40 percent higher than the releases in 1983 and 1984.

Average O&M expenditures per hectare of service area in 1982 for national irrigation systems for each of the 12 regions of the country are presented in the ninth column of Table 5.7. In general, the range of the figures is about P150-230/ha. Similar data on each of the 12 systems of Region 3

Table 5.6. Operation and maintenance costs of national irrigation systems, 1979-1984.

Year	Service area (ha)	Total O&M fund releases (million current Pesos)			O&M fund releases/ha of service area		Personnel as percent of total
		Personnel	Others	Total	Current Pesos	1984 Pesos[a]	
1979	477239	58.95	7.20	66.15	139	320	89.1
1980	472008	76.70	9.05	85.75	182	364	89.4
1981	492336	93.06	10.39	103.45	210	380	90.0
1982	508578	93.76	14.38	108.14	213	355	86.7
1983	549926	86.61	14.38	100.99	184	275	85.8
1984	559447	103.57	28.78	132.35	237	237	78.3

[a]Current Pesos converted to 1984 using Implicit GDP Deflator (Asian Development Bank 1985).
Source: National Irrigation Administration (1985a).

are presented in the penultimate column of Table 5.8. The average expenditure for this region was P232/ha, with a range of about P130-430/ha. Expenditure in the Upper Pampanga River Integrated Irrigation System (UPRIIS), by far the largest irrigation system in the country, was P250/ha.

Table 5.7. Irrigation service fee collections and O&M expenses for national irrigation systems, by region, 1982.

Region	Number of national irrigation systems	Total service area ('000 ha)	Collectibles		Collection[a]		O&M expenses		Collections as percent of O&M expenses
			Total ('000 pesos)	Per ha pesos	Amount ('000 pesos)	Efficiency (percent)	Total ('000 pesos)	Per ha (pesos)	
1	20b	47.0	9960	212	5404	54	9887	210	55
2	13	101.5	21585	213	13483	62	12864	127	105
3	12[b]	172.0	51071	297	27702	54	39998	232	69
4	23	49.9	9376	188	6227	66	9008	180	69
5	14	16.4	4036	246	2027	50	4960	303	41
6	14	53.1	12972	244	9263	71	8545	161	108
7	2	0.5	47	94	36	77	103	226	35
8	11	14.9	2916	196	1624	56	3323	223	49
9	4	11.3	2650	235	2069	78	1549	137	134
10	3	9.7	1413	146	923	65	562	58	164
11	10[b]	30.4	4621	152	3634	79	4335	142	84
12	7	25.0	5389	216	4363	81	4071	163	107
Total	133	531.9[c]	126037	237	76757[d]	61	99206	187	77

[a]Data are from the systems reports to the Systems Management Department, NIA.

[b]Each of the subsystems in Regions 1, 3 and 11 having the same designation is counted as one unit system.

[c]Total irrigation service area varies from season to season and year to year according to the availability of irrigation water.

[d]This total figure is much higher than the audited figure of 58,430 (see Table 5.29).
Source: Japan International Cooperation Agency (1984).

Table 5.8. Irrigation service fee collections and O&M expenses for national irrigation systems in region 3 (1982).

System	Total service area (ha)	Collectibles		Collection		O&M Expenses		Collection as percent of O&M expenditure
		Total ('000 pesos)	Per ha (pesos)	Amount ('000 pesos)	Efficiency (percent)	('000 pesos)	per ha (pesos)	
Angat-Maasin	31371	9309	296	6647	71	8671	276	77
Porac-Gumain	5015	1437	287	662	46	841	168	79
Colo	467	142	283	129	91	174	373	74
Tama	77	26	343	15	56	42	551	35
Caulaman	562	162	289	90	56	241	428	38
San Juan	68	15	223	10	66	68	1005	15
Sto. Tomas	3448	831	245	579	70	753	219	77
Nayom	1158	343	238	221	64	384	332	58
Tarlac	9763	1114	114	805	72	1281	131	63
Smoris	8645	1201	140	487	41	761	88	64
Camiling	8885	1546	174	724	47	1171	132	62
UPRIIS	102588[a]	34945	331	17334	50	25609[b]	250	68
Total	172047	51071	297	27702	54	39998	232	69

[a]In the O&M expenses in this table, expenses for the UPRIIS support divisions in the main office are not included.
Note: In this report, 92,000 ha is used as standard irrigation service area.
Source: Japan International Cooperation Agency (1984).

The service area of irrigation systems represents the area commanded by the irrigation facilities, but the actual irrigated area is often considerably less. Aggregate data on irrigated areas, by season, are compared with the service area figures in Table 5.9 for the years 1975-1984. In recent years, the area served in the wet season has amounted to only about 75 percent of the service area. It is reasonable to assume that the area irrigated in the dry season is a portion of that which is irrigated in the wet season, and that the remainder of the service area is not actually irrigated in either season. Based on the data on O&M fund releases for 1984 (Table 5.6) and the wet season area irrigated for 1984 shown in Table 5.9, the average expenditure for O&M in 1984 was P314/ha actually irrigated.

O&M of national irrigation systems has always suffered from shortages of funds. As can be noted from Table 5.6, most of the O&M expenditures are for personnel costs, leaving a very small amount for the actual maintenance. A World Bank paper (1982) reports on the near absence of any efficient mechanical equipment to maintain the systems properly, and the lack of physical facilities and discipline to ensure adequate and timely distribution of water to farmers. This has led to the agency losing credibility with its clients and the subsequent low rates of collection of water charges. This has been described as a vicious circle where inability to collect water charges leads to decreased funds, less maintenance, greater farmer frustration, and lower payments of water charges.

Table 5.9. Service and irrigated areas in national irrigation systems.

Year	Service area ('000 ha)	Irrigated area				
		Wet season		Dry season		Dry season area as percent of wet season
		'000 ha	Percent of service area	'000 ha	Percent of service area	
1975	399.7	348.8	87.3	178.2	44.6	51.1
1976	448.8	378.2	84.3	238.0	53.0	62.9
1977	459.3	384.0	83.6	204.8	44.6	53.3
1978	466.1	368.0	79.0	271.8	58.3	73.9
1979	477.2	373.3	78.2	279.3	58.5	74.8
1980	472.0	374.6	79.4	288.9	61.2	77.1
1981	492.3	371.8	75.5	294.5	59.8	79.2
1982	508.6	390.5	76.8	317.2	62.4	81.2
1983	549.9	362.5	65.9	288.5	52.5	79.6
1984	559.4	421.2	75.3	267.6	47.8	63.5

Note: [a]Includes area of second and third crops.
Source: National Irrigation Administration (1985a).

Table 5.10. Operation and maintenance cost in UPRIIS, 1978-1982, in '000 Pesos.

	1978		1979		1980		1981		1982	
	Current Pesos	1984 Pesos	Current Pesos	1984 Pesos	Current Pesos	1984 Pesos	Current Pesos	1984 Pesos	Current Pesos	1984 Pesos
1. Personnel expenses	16302.2	43383.9	19695.4	45303.4	23472.3	46958.3	27029.1	48903.7	27581.5	46000.9
a. Salaries	13854.6		16990.0		13989.0		14318.5		15055.2	
b. Government share	968.7		1061.0		1236.3		1247.1		0062.6	
c. Wages	1478.9		1635.4		1222.2		0044.9		0096.7	
d. Cost of living allowance	-		-		5511.5		6153.0		5845.4	
e. Amelioration allowance	-		-		1492.0		1555.8		1619.9	
f. Representation allowance	-		-		21.3		44.5		47.2	
g. Incentive allowance	-		-		-		2301.4		1975.3	
h. Pag-ibig fund	-		-		-		63.9		279.2	
2. Other expenses	2558.7	6809.3	2019.5	4645.3	3189.1	6380.1	3210.8	5809.3	5759.0	9607.7
a. Travelling expenses	282.2		135.3		322.4		262.3		266.4	
b. Sundries and other expenses	1010.6		499.1		465.1		533.4		720.2	
c. Supplies and materials, spare parts	1265.9		1385.1		1101.7		522.4		1228.0	
d. Water, illumination and power services	-		-		183.0		174.4		290.6	
e. Gasoline and oils	-		-		1116.9		1718.3		3095.5	
f. Collection expenses	-		-		-		-		135.5	
g. Purchase of equipment	-		-		-		-		228.8	
Total (1+ 2)	18860.9	50193.2	21714.9	49948.6	26661.4	53338.4	30239.9	54713.0	33340.5	55621.6
Ratio of personnel expenses/ total O&M cost (percent)	86.4		90.7		88.0		89.4		82.7	

Source: Japan International Cooperation Agency (1984).

The national expenses for personnel services (including salaries, government share, wages, allowances, and *pag-ibig* fund) have averaged 87 percent of the total O&M fund releases in the past 6 years (Table 5.6). Personnel expenses averaged 87.4 percent of the total O&M cost of UPRIIS, (Table 5.10) during 1978-1982, but have dropped from a high of 90.7 percent in 1979, to 82.7 percent in 1982. Other O&M expenses of this system include travel expenses, sundries, supplies and materials, spare parts, water, illumination and power services, and gasoline and oil. The total nominal amount of these expenses has more than doubled from P2,558,700 in 1978, to P5,759,000 in 1982, but in real terms the increase has only been 16 percent.

NIA is undertaking measures to improve the O&M situation in the national irrigation systems. These measures are the reduction of personnel and expenses for O&M, and the sharing of expenses with the systems concerned. A resolution approved by the NIA Board calls for the retention of only 1,276 out of 1,654 positions for UPRIIS. Most of the positions affected are those of field staff such as water management technicians, assistant technicians, water masters, and ditchtenders. Ditchtenders are now being discharged as their age or service period requirements for retirement are satisfied. NIA has also liberalized its guidelines for the payment of separation benefits.

Pump irrigation systems. Estimates of O&M costs for some pump irrigation systems developed by Moya (1985) are presented in Table 5.4. Data for additional systems are presented in Table 5.11. For the Solana-Tuguegarao and the Angat-Maasim River Irrigation Systems, the cost data are limited to the cost of power consumption for pumping. The cost of electric power is variable, depending on the source (which may be a private franchise holder, the Manila Electric Company, or a rural electric cooperative). To operate pump irrigation systems, entails from two to over seven times the cost of national irrigation systems.

Table 5.11. Operation and maintenance costs in selected pump irrigation systems.

System	Service area	O&M cost (P)	Cost/ha (P)	Remarks
Bonga Pumps	1174	920468	784	
Solana-Tuguegarao	1320	2301826	1744	Power consumption only
Libmanan-Cabusao	3427	2411475	704	
Angat-Maasim River Irrigation Systems				
Tibagan	1237	1438108	1163	Power consumption only
Bustos-Pandi	351	181076	516	do
Bustos-Pandi Ext.	730	373483	512	do

Source: National Irrigation System (1985a).

Desirable O&M Costs for National Irrigation Systems

A World Bank funded Operation and Maintenance Study (Phase III) conducted for NIA by PRC Engineering Consultants Incorporated of Colorado, USA and Sycip, Gorres, Valayo and Company of Manila, estimated a "desirable" O&M cost of P386.50/ha of service area, which would

represent a more than 60 percent increase over the average O&M expenditures for national irrigation systems in 1984. About one-third (P130/ha) of this "desirable" cost is for operation costs, and nearly two-thirds (P249/ha) is for maintenance. In addition, P7.50/ha was suggested for training.

FARMERS' ABILITY TO PAY FOR IRRIGATION SERVICES

Price Policies

A comprehensive study on the impact of economic policies on agricultural development (the Philippine Institute for Development Studies and the Philippine Council for Agriculture and Resources Research and Development 1982) and a World Bank report on pricing policy (1984b), conclude that price intervention policies in the Philippines have created an incentive structure that is significantly biased against agriculture. The findings show that the increasing regulations on the agriculture sector in the 1970s led to an undervaluation of exportable products through export quotas, export taxes, special levies, and government monopoly of marketing. The sector was, likewise, penalized by the overvaluation of the Philippine peso, and by low agricultural prices which had been artificially depressed to raise the profitability of the industrial sector.

Output price policies. Because almost all irrigated lands are rice fields, the output for which pricing policy has a significant bearing on irrigation is that of rice. Until mid-1985, government regulations set floor and ceiling prices for rice. The National Food Authority has had a monopoly on international rice trade operations.

The policy of the National Food Authority is to attempt to purchase a sufficient quantity of the rice crop to defend the floor price, and to create a stockpile for release into the domestic market during times of shortages. Financing for the activities of the Authority comes from a) subsidized lines of credit from government-owned banks; b) the government (public) budget; and c) internally generated funds from the Authority's importation of wheat, soybean meal, and yellow corn, and from licensing fees. Although the Authority thus has access to "cheap" sources of funds, it still experiences cash flow problems, so that its share of the market has remained small (about 10 percent of the total).

Price policies for inputs other than water. The effect of government interventions on the price paid by farmers for fertilizer has been quantified in terms of the estimated implicit tariffs on the major grades of finished fertilizer from 1973-1981 (David and Balisacan 1982). The weighted average implicit tariffs (i.e., the percentages by which the prices farmers paid differed from border prices) ranged from a negative 5 percent in 1973 to a positive 56 percent in 1976 (Table 5.12). Between 1975 and 1979, the implicit tariff range was 19-41 percent. From 1973-1975, when a two-tier pricing system was in effect, the food crop sector received substantial price subsidies. Fertilizer for food crop production was sold at prices 50-70 percent less than fertilizer for export crops. In 1975, however, the food and export crop sectors enjoyed a price subsidy of about 46 and 14 percent, respectively. This occurred because the Fertilizer Industry Authority lowered the price of urea, ammonium sulfate, and mixed

fertilizer to the export crop sector to draw down the large inventory which resulted from the government's decision to double fertilizer imports in 1974. The decision to double imports in 1974 and the very high prices paid for these imports resulted in huge losses to the fertilizer industry. Problems in enforcing a two-tier price system and the decline in the world price of fertilizer encouraged the adoption of a single price system starting 1976.

Table 5.12. Estimated implicit tariffs on four grades of finished fertilizer, 1973-1981 (percent of border prices).

		Fertilizer grade				
		Urea	Ammonium sulfate	Mixed	Muriate of potash	Weighted average
1973	I Food crops	-25	-9	-49		-5[a]
	II Export crops	31	39	-2	119	
1974	I Food crops	-11	-23	-33		7
	II Export crops	50	44	17		81
1975	I Food crops	-39	-43	-56	30	
	II Export crops	-5	-5	-31	86	
1976		65	86	30	85	56
1977		55	59	13	105	41
1978		28	37	-5	96	19
1979		34	52	15	89	32
1980		7	-43	-14	68	5
1981		8	45	-11	80	7
Weighted average		16	27	-4	86	10

[a]From 1973-1975, figures refer to weighted average of Priority I and II prices. Fertilizer for the food crop sector was sold at prices 50-70 percent less than the prices for export crops.

Implicit tariff = $\frac{[P_d \quad]}{[P_d \quad]} \times 100$ where P_b denotes border price, P_d is domestic wholesale price, ex-Manila.

These two prices are assumed to be at a comparable point in the marketing chain, so that the differences between domestic and border prices may be attributed to government interventions like import quotas and price controls.

Source: David and Balisacan (1982).

In 1976, implicit tariffs increased to a level of 56 percent above world prices, supposedly to allow the fertilizer industry to recoup losses incurred during the 1973-1975 period. The levels of the implicit tariffs have since declined, and in recent years have been estimated to average five to seven percent.

The government has applied different pricing policies to the different types of fertilizer. Although the mixed fertilizer grade has received a modest price subsidy, David and Balisacan (1982) found that for the period of 1973-1982, prices paid by farmers for urea and ammonium sulfate respectively averaged, 16 and 27 percent higher than border prices. The price of muriate of potash, the fertilizer widely used for sugarcane production, has averaged 86 percent above border prices.

The fertilizer price policy is probably the most important input price policy affecting farmers' ability to pay for irrigation services. In addition, government policies lead to implicit tariffs on machinery, farm chemicals other than fertilizer, and fuel. Some credit is available at subsidized interest rates; however, the volume of agricultural credit receiving these subsidies is small.

Considering the overall situation with input and output pricing policies, a World Bank report (1984b) concluded that the discrimination against rice farming implied by the input and output price polices noted above was approximately balanced by the government subsidy of irrigation costs (investment costs plus some of the O&M costs). Thus, the implicit taxation of rice production through output and nonirrigation input price policies, significantly reduces the ability of farmers to pay directly for the cost of the irrigation services.

Changes in government policies in 1985. The revitalization of the agricultural sector is considered crucial for a quick and strong recovery of the Philippine economy. Policy changes in agricultural pricing are embodied in a memorandum on the Revitalization of the Agricultural Sector. The provisions include:

1. Complete deregulation of rice prices, in order to improve incentives to farmers for more rice production; support prices are to be adjusted upwards in proportion to increased production costs, to ensure price and supply stability; the buffer stock operations of the National FoodfAuthority are to be strengthened.

2. Full implementation of the policy to allow all sectors to import and distribute fertilizer.

3. Gradual removal of subsidies on agricultural credit and on irrigation. This policy, to be implemented over a period of not less than one year, is expected to reduce government costs further, improve the profitability of industries providing such inputs, and stabilize prices over the medium-term.

Earlier policy changes included the lifting of all price controls except on rice, and the removal of the National Food Authority's monopoly on the import of feed grains.

Tax Policies

The primary tax which may affect the farmers' ability to pay for irrigation services is the real property tax. This is an *ad valorem* tax based on the assessed value of the property. For agricultural property, the assessed value is limited to 40 percent of the market value. The tax that would apply to agricultural lands would generally be levied by the provincial governments, which are required to tax real property at rates between 0.25 and 0.50 percent of the assessed values. Thus, agricultural lands may be taxed at 0.1-0.2 percent of their market value. To the extent that assessments fail to reflect changes in market conditions fully, it is likely that the effective rates of payment would be less than these figures.

Table 5.13. Average costs and returns in rice production, all National Irrigation System Improvement Program I and II systems, 1983-1984.

	Dry season 1983	Wet season 1983	Dry season 1984
I. GROSS RETURN			
A. Yield (Mt./ha)	3.4	3.9	4.3
B. Total value (P/ha)	5039	5877	8999
II. PRODUCTION COST (P/ha)			
A. Cash/in-kind cost			
1. Material cost			
a. Seeds	188	193	206
b. Fertilizer	187	306	172
c. Pesticides	396		
Weedicides	35	42	387
Insecticides	225	241	
Rodenticides	2	5	
SUB TOTAL	845	788	765
2. Labor inputs			
a. Land preparation	359	311	305
b. Transplanting/Direct seeding	217	233	373
c. Weeding/Crop management	93	151	53
d. Harvesting/Threshing/Drying	706	707	1255
SUB TOTAL	1375	1402	1986
3. Others			
a. Land charges	616	680	1087
b. Irrigation service fee	212	190	329
c. Interest on loans	71	139	233
d. Other expenditure (land tax, etc.)	-	0.23	
SUB TOTAL	898	1009	1649
TOTAL FOR A	3118	3198	4400
B. Noncash cost (imputed family labor)			
1. Land preparation	204	296	465
2. Transplanting/Direct seeding	18	41	18
3. Weeding/Crop management	123	105	161
4. Fertilizer/Spraying	16	22	-
5. Harvesting/Threshing/Drying	60	69	35
6. Other expenses	162	254	568
TOTAL FOR B	582	786	1247
TOTAL FOR A & B	3701	3984	5647
III. NET RETURN (P/ha)			
A. Above cash/in-kind cost	1921	2678	4599
B. Above total cost	1339	1892	3352

Source: National Irrigation Administration (1984a).

The importance of the real estate tax on the farmers' ability to pay for irrigation water is indicated by data used for the establishment of the market value of irrigated rice land for taxation purposes. Data for 1980 (the most recent year for which separate data on irrigated land are available) from selected municipalities in the provinces of Bulacan, Laguna, North Cotabato and Iloilo show market values of irrigated rice field area to vary from as low as P2,870/ha to as high as P18,000/ha. Applying the maximum rate of tax to these figures implies a tax range of P636/ha. Taxes of this magnitude would have little effect on the ability of farmers to pay for irrigation services.

Another indication of the lack of importance of the real estate tax on farmers' ability to pay for irrigation services comes from data collected as part of NIA's input-output monitoring study in selected irrigation systems. Data from three seasons indicate that the average land tax paid was less than one peso per hectare (Table 5.13). If the amounts actually paid are as low as these data indicate, then either assessments are much below market values, or there is considerable nonpayment of taxes.

Irrigation Benefits and the Farmers' Ability to Pay for Irrigation Services

Data on the average production benefits of irrigation for the nation are not available. It is therefore necessary to rely on the results of individual studies of specific projects to gain some idea of the probable magnitude of these benefits.

The Input-Output Monitoring Program of the National Irrigation System Improvement Program has obtained data on the average costs and returns to rice production in the National Irrigation System Improvement Program systems for the 1983 wet and dry seasons and for the 1984 dry season (Table 5.13). Converting the costs of production to unmilled rice at the 1983 farmgate price of P1.46 per kilogram (kg), and assuming that all land is owned by the farm family, these data indicate a return to family resources (land, labor, capital, and management), before payment of the irrigation fees, of 1,831 kg unmilled rice/ha in the 1983 dry season; 2,305 kg/ha in the 1983 wet season; and 2,256 kg/ha in the 1984 dry season.

If one assumes that there are no wet season benefits from irrigation (an obvious underestimate of the true situation), and that a farmer is able to grow an irrigated dry season crop on about three-fourths of his area (which represents about the average proportion, in recent years, of the area irrigated in the dry season to that of the wet season — see Table 5.9), then the average annual benefit of irrigation (measured in terms of the average increase in net returns to family resources) would be about 1,533 kg/ha (three-fourths of the average net returns for the two dry seasons).

The above estimates were made on the unrealistic assumption of no wet season benefits. Data from a study conducted by the Bureau of Agricultural Economics of the Ministry of Agriculture (Tepora et al. 1984) provide a basis for comparing average costs and returns for wet season irrigated and rain-fed rice for 1983 (Tables 5.14 and 5.15). The net income figures are calculated in terms of the returns to family-owned resources (land, labor, capital, and management), under the assumption that the family owns all the land farmed. The difference between the irrigated and rain-fed figures is 469 kg rice/ha. Adding to this the 100 kg/ha spent for irrigation service fees in the irrigated areas gives an increase in

net income prior to paying for water charges of 569 kg rice/ha for the wet season. Combining this with the above estimate of 1,533 kg/ha as the average increase in income during the dry season gives an estimate of about 2,100 kg rice/ha as the total increase in net income.

Table 5.14. Approximate average costs and returns to irrigated wet season rice production, 1983.

Item	Amount in P/ha	Kg rice/ha[a]	Percent value of total production
1. Gross receipts	4938	3382	100.0
2. Water charges			
a. for O&M	142	80	2.4
b. for capital repayment	36	20	0.6
3. Other purchased current inputs, excluding labor	733	502	14.8
4. Hired labor	1175	805	23.8
5. Returns to family resources (if family owns all land farmed)	2852	1975	58.4

[a]Conversion of P/ha to kg rice/ha.
Item 2 is computed at P 1.78/kg, the support price. Items 1, 3, 4 and 5 are computed at P 1.46/kg, the actual price received by farmers.
Sources: computed from Tepora et al. (1984).

Table 5.15. Approximate average costs and returns to rain-fed rice production, 1983.

Item	Amount in P/ha	Kg rice/ha[a]	Percent value of total production
1. Gross receipts	3497	2445	100.0
2. Water charges	0	0	0
3. Other purchased current inputs excluding labor	42	299	12.2
4. Hired labor	915	640	26.2
5. Returns to family resources (if family owns all land farmed)	2154	1506	61.6

[a]Price received by farmers was P 1.43/kg and this was used in computing for the kg rice/ha.
Source: computed from Tepora et al. (1984).

In 1984 the average O&M cost per hectare irrigated was P314. At the 1984 support price of P2.23/kg, this implies that O&M costs are equivalent to approximately 141 kg/ha. Thus about seven percent of the net benefits of irrigation would be needed to pay for the average O&M costs. The current irrigation service fee in most irrigation projects is 100 kg of rice/ha in the wet season and 150 kg of rice/ha in the dry season (see section Direct Methods, under Methods of Financing Irrigation Services). Considering that the dry season fee would be paid on only 75 percent of the area

irrigated in the wet season, the average annual payment would come to 213 kg/ha, which is equivalent to about 10 percent of the net incremental benefits of irrigation.

Moya (1985) studied the costs and benefits of 12 irrigation systems. The range of the estimated net benefits for these systems was about P1,100-2,500/ha, in 1980 prices. The average O&M cost of P314/ha irrigated in 1984 would thus comprise 1329 percent of the net benefits. Payment of irrigation service fees would require 19-43 percent of the net benefits.

In research conducted in the Libmanan-Cabusao Pump Irrigation System (LCPIS), Moya (1984) estimated the income earned by farmers in two types of irrigated area (flood-free and flood-prone) and in rain-fed areas (Table 5.16). The estimated income levels were low — with the rain-fed farmers earning less than the assumed opportunity cost of their family labor. Irrigation resulted in significant increases in the net income, with the increase being about P3,400/farm for flood-free areas, and about P1,220/farm for the flood-prone areas. The range of farm sizes was 1.3-1.5 ha. Using a representative figure of 1.4 ha/farm, these figures imply increases in net income of P2,430/ha in the flood-free areas and P870/ha in the flood-prone areas.

Table 5.16. Comparative net surplus per farm per annum, irrigated and rain-fed farms, LCPIS, Camarines Sur, at constant 1984 prices.

	Irrigated		Rain-fed	Difference	
	Flood-free	Flood-prone		Rain-fed versus flood-free	Rain-fed versus flood-prone
Value of output	12874	8547	3809	9065	4738
Costs of production					
a) Material inputs	2270	1664	869	1401	795
b) Labor	3711	2820	1695	2016	1125
Hired	2092	2032	1032	1870	1000
Family	809	788	663	146	125
c) Miscellaneous costs	2168	1568	927	1241	641
d) Land rent	1601	1564	608	993	956
Total costs	9759	7616	4099	5651	3517
Net surplus	3124	931	(290)	3414	1221

Source: Moya (1984).

Implications of Alternative Policies

Based on some of the data discussed above, indicative estimates of the costs and returns to irrigated rice production in the Philippines are presented in Table 5.17. To facilitate comparison with the other study countries, the data are expressed in terms of kilograms of unmilled rice. The annual figures are based on the assumption that an irrigated farmer is able to grow an irrigated wet season crop on his entire area each year, and an irrigated dry season crop on three-fourths of his area. The returns to family-owned resources (assuming all land is owned by the family) are shown in the last line of the table.

Table 5.17. Indicative costs and returns to irrigated rice production (kg unmilled rice/ha).

Item	Wet season[a]	Dry season[b]	Per year[c]
Gross receipts	3382	3850	6270
Water charges[d]	100	150	200
a. for O&M	-	-	176
b. for capital repayment	-	-	37
Other purchased current inputs, excluding labor	502	655	993
Hired labor	805	1151	1668
Returns to family-owned resources (if family owns all land farmed)	1975	1894	3396

[a]From Table 5.14.

[b]Computed from Table 5.13 averaging the 2 dry seasons. Peso cost converted at P 1.46/kg.

[c]From columns 1 and 2 assuming dry season crop planted on 75 percent of area.

[d]100 kg of unmilled rice per hectare irrigated in wet season and 150 kg in dry season.

The data in Table 5.17 are based on the present policy of cost recovery, namely, that farmers pay in rice, the current irrigation service fee of 100 and 150 kg/ha irrigated in the wet season and the dry season, respectively. Assuming a dry season crop on 75 percent of the area, the average total irrigation fee per hectare is 213 kg of rice/year. Because at the official price in 1983 of P1.78/kg, the O&M costs per hectare irrigated (P314/ha) are equivalent to only 176 kg, and the residual amount of 37 kg is considered to be a payment to capital costs.[2]

Costs and returns to farmers under this policy are compared in Table 5.18 with hypothetical costs and returns calculated under the assumption that policy is changed to require full cost recovery of all O&M plus capital costs. The analysis is presented for two alternative assumptions of the level of capital investment — a low cost assumption of US$1,000/ha, and a high cost assumption of US$2,500/ha. O&M costs are based on the current average O&M cost of P314/ha irrigated.

As can be seen from Table 5.18, even at the low investment cost of US$1,000/ha, the irrigation service fee needed for full cost recovery would increase from the current level of 213 kg/year (which is about 3.4 percent of total production) to 944 kg, or about 15 percent of total production. For the high investment cost situation, the increase would be to 2,095 kg, representing about 33 percent of total production. In either case, the effect is to create a substantial reduction in the returns that would be earned by the farm family. Returns to family-owned resources would decline by about 22 percent in the low investment cost situation, and by 55 percent in the high investment cost situation.

[2]This analysis is thus a farm-level analysis, and assumes that the entire fee is paid. As is discussed more comprehensively in the section on Collection Efficiencies, low rates of fee collection are a serious problem for the National Irrigation Administration, so that even at fee rates which are above the average O&M cost per hectare, the Administration's total collections remain below its O&M expenditures.

Table 5.18. Hypothetical costs and returns to irrigated rice production, 1983, assuming changes in policies regarding water charges (kg unmilled rice/ha/year)[a].

Item	Present policy	Water charges revised for 100 percent cost recovery (O&M plus capital cost) assuming	
		Low[b] investment cost	High[c] investment cost
Gross receipts	6270	6270	6270
Charges related to water			
a. O&M	176	176[d]	176[d]
b. Capital cost	37	768	1919
Other purchased current inputs excluding labor	993	993	993
Hired labor	1668	1668	1668
Returns to family-owned resources (if family owns all land farmed)	3396	2665	1514

[a]Using figures from Table 5.17.

[b]US$1,000/ha. Amortized assuming interest rate of 10 percent and 50 year life.

[c]US$2,500/ha. Amortized as above.

[d]Assuming an average O&M cost of P314/ha irrigated converted at the support price of P1.78/kg.

In order to place these returns in a perspective which will facilitate comparisons among the other study countries, we have related them to two reference levels of income. Data underlying these reference income levels for the Philippines are presented in Table 5.19. The first reference level is what we have termed "parity household income" expressed on a per hectare basis (item 5 of Table 5.19). "Parity" income represents a level of per capita income from crop production which would give a farm household an income comparable to the average per capita income for the Philippines, assuming that crop production is the household's only source of income. In reality, other sources of income frequently exist, so these income levels overstate the level of crop income which many households would need to achieve "parity." They are, however, indicative of conditions on farms with no other sources of income. The second reference income level is an estimated absolute poverty level of income, based on data compiled by the World Bank (1984a). As in the case of the "parity" income, it has been adjusted to a per hectare basis, again on the assumption that crop income is the only source of income for the farm household.

Table 5.19. Calculation of income reference levels, 1983.

Average per capita income (P)[a]	7404
Average farm household size (persons)[b]	5.7
Parity farm household income (P) (1 x 2)	42203
Average farm size (ha)[c]	1.2
"Parity" household income per hectare (P) (3 · 4)	35169
Estimated per capita absolute poverty income level (P)[d]	1866
Estimated farm household "poverty" income (P) (2x6)	10636
Estimated poverty level of income per hectare (P) (7/4)	8863

[a]NAS, National Economic Development Authority.

[b]NAS, National Economic Development Authority, Study on Low Income Groups (1985).

[c]Tepora et al. (1984).

[d]1981 Estimate of US$195 taken from World Bank (1984a) Social Indicator Data Sheets, and converted to P1,540 at 1981 exchange rate of P7.9 per dollar. Using the Implicit GDP Deflator, this was calculated to be P1,866 at 1983 prices.

As is shown in Table 5.20, under current policy, the returns to family resources are only 14 percent of the "parity" income level, and 56 percent of the "poverty" level. These low returns are consistent, at least

Table 5.20. Estimated effects of changes in policy regarding water charges 1983.

	Present policy	Assumed policy on water charges	
		Water charges revised to cover O&M plus 100 percent of capital cost assuming initial capital cost level is	
		low	high
Farm returns (kg unmilled rice ha)[a]			
Returns to family resources (if all land is owned by family)	3396	2665	1514
Farm returns relative to "parity" (percent) Returns to family resources (if all land is owned by family)	14	11	6
Farm Returns relative to "poverty" (percent) Returns to family resources (if all land is owned by family)	56	44	25

[a]From Table 5.18.

[b]"Parity" crop production income per hectare of P35,169 (from Table 5.19) or 24,088 kg unmilled rice.

[c]"Poverty" crop production income per hectare of P8,863 (from Table 5.19) or 6,071 kg unmilled rice.

qualitatively, with the results of several studies that have examined farm incomes. In a study conducted by Tagarino and Torres (1976) examining the farmer's capacity to pay for irrigation services, in the Upper Pampanga River Project, farm income (net value of production plus the imputed value of unpaid operator and family labor) was found to be generally below what was considered to be a minimal level of family living expenses. In a subsequent survey (Japan International Cooperation Agency 1984) in the same area in 1982-1983, 28 percent of the farm households still have incomes below the minimal level. Living conditions for amortizing farmer-owner operators with less than one hectare and lessees with less than two hectares remain at the subsistence level.

Another study (Economic Development Foundation 1981) compared estimates of family incomes with the poverty threshold income level (Table 5.21). At actual farmgate or government support prices in 1979, the average amounts of family incomes in excess of the poverty income level are significantly on the negative side in all but three regions in the country.

Table 5.21. Estimated family income versus poverty threshold level[a] (1979).

Region	Family income (P)	Poverty threshold income (food and other needs) (P)	Surplus (Deficit) Income	
			(P)	Equivalent cavans of palay
1	1940.34	14495	(12554.66)	(223.47)
2	6429.49	13783	(7353.51)	(140.44)
3	22143.36	15805	6338.36	97.66
4	7666.63	13922	(6255.37)	(119.93)
5	10732.23	13140	(2407.77)	(49.09)
6	21973.00	11630	10343.00	219.60
7	16927.71	12067	4830.71	95.28
8	3726.36	11757	(8030.64)	(171.59)
9	2743.39	13090	(10346.61)	(217.36)
10	3707.56	15793	(12085.44)	(236.74)
11	6158.30	13590	(7431.70)	(154.83)
12	12128.58	14095	(1966.42)	(41.10)
Average all regions	11685.15	14151	(2465.85)	(45.22)

[a]Estimates used actual Farmgate Price of unmilled rice.

Source: Economic Development Foundation (1981). The study used 1978 estimates of the Population, Resources, Environment, and the Philippine Future project of the Development Academy of the Philippines — adjusted to 1979 levels by using the Consumer Price Index of the National Economic and Development Authority.

The Input-Output Monitoring Program — National Irrigation Systems Improvement Program of NIA obtained similar results. Although farm families in the Ilocos, Cagayan and Leyte provinces had some family savings, the average actual family living expenses in all the selected regions have been well below the poverty threshold income level (Table 5.22).

Table 5.22. Income, living expenses, and poverty threshold expenses in selected regions (1979)[a].

	01 Ilocos	02 Cagayan	04-05 South Luzon	06 West Visayas	08 Leyte	09-12 Mindanao
I. Family income						
(a) Farm						
1. Rice	457	4846	2056	1563	797	4735
2. Other crops/ livestock	1241	725	273	1509	1657	370
SUB TOTAL	1698	5571	2329	3072	2454	5105
(b) Non-farm	3032	3006	3279	4003	2596	3071
II. Total disposable income	4730	8577	5608	7075	5050	8176
III. Family living expenses	3710	7589	9160	10136	4522	9860
IV. Family savings	1020	988	(3552)	(3061)	528	(1684)
V. Poverty threshold expenses (1979)	14495	13783	13922-13140	11630	11757	13090-14095
Average farm size	0.78	2.57	1.25	1.61	1.38	1.87
Average household size	5.5	5.8	5.80	6.0	5.3	6.9

[a] *Source*: Poverty Threshold Expenses taken from Economic Development Foundation (1981), as based on a study done by the Development Academy of the Philippines. All other data are obtained from results of surveys done by the National Irrigation Administration's Input-Output Monitoring Program under National Irrigation Systems Improvement Program I and II.

Given the low returns earned by farmers under current policy, any policy attempting full cost recovery of O&M plus capital costs would have severe implications for the welfare of farmers. Under the assumption of low investment costs, such a policy would lower the returns to family resources to 11 and 44 percent of the "parity" and "poverty" reference incomes, respectively (Table 5.20). Full cost recovery with the assumption of a high investment cost results in returns to family resources that are only 25 percent of the "poverty" reference level. To the extent that National Irrigation Administration is unable to collect the fees from 100 percent of the farmers, the fee levels necessary for full cost recovery would have to rise even further. It is apparent that a full cost recovery policy would not be feasible without imposing substantial hardships on the farmers.

METHODS OF FINANCING IRRIGATION SERVICES

Direct Methods

General policies. The main financing mechanism for obtaining resources from the beneficiaries of irrigation has been irrigation service fees levied on the basis of a flat rate per hectare for each season (wet and dry). Such fees have been officially levied from at least 1946. Since 1966, the rate of levy for the dry season crop has been higher than for the wet season crop. Since 1975, higher rates have been charged for pump irrigation systems than for national irrigation systems.

Table 5.23 shows the irrigation fee rates for the period 1946-1984. The real values of these rates, deflated by the price index for services, are given in Table 5.24 expressed in 1984 pesos. Since 1975, the irrigation fees paid by farmers have been denominated in terms of rice. This has provided a degree of indexation against inflation and has freed NIA from the difficult task of frequent recourse to the President of the Philippines in order to raise the level of water rates (World Bank, 1982). The farmers may either pay in-kind or the equivalent amount in cash, based on the government support price of rice. Thus, the cash equivalent of the fee increases with any increase in the support price. In spite of this, the irrigation service fee rates have declined by about 35 percent in real terms since 1975.

Table 5.23. Irrigation service fee rates in national irrigation systems, by type of system and by season, 1946-1984 (P/ha).

Year	Pump system		Gravity system	
	Wet season	Dry season	Wet season	Dry season
1946-1966	12	12	12	12
1966-1975	25	35	25	35
1975[a]	150	250	100	150
1976	165	275	110	165
1977	165	275	110	165
1978	165	275	110	165
1979	195	325	130	195
1980	210	350	140	210
1981	227	378	151	226
1982	248	413	165	248
1983	267	445	178	267
1984	335	558	223	335

[a]Starting in 1975, irrigation fee rates have been set at two cavans per hectare during the wet season and three cavans per hectare during the dry season for gravity systems, and three cavans per hectare during the wet season and five cavans per hectare during the dry season for pump irrigation systems. The cash equivalent is based on the government's support price for palay. (1 cavan = 50 kg).

Source: National Irrigation Administration.

Table 5.24. Real value of irrigation service fee rates in national irrigation systems by type of system and season, 1975-1984 (1984 P/ha).

Year	Pump system		Gravity system	
	Wet season	Dry season	Wet season	Dry season
1975	514	856	343	514
1976	516	860	344	516
1977	471	786	314	471
1978	439	732	293	439
1979	449	748	299	449
1980	420	700	280	420
1981	411	684	273	411
1982	414	689	275	414
1983	399	664	266	399
1984	335	558	223	335

Note: Nominal values were deflated by the Implicit GDP Deflator (Asian Development Bank 1985).

Although the fees shown in Table 5.23 apply to most irrigation systems, there are some exceptions. Details on the current rates of irrigation fees in various systems are presented in Table 5.25.

Table 5.25. Irrigation service fee rates (cavans[a]/ha), 1985.

Type of system	Rice[b]			Annual crops[c]
	Wet season	Dry season	Third crops	
Pumps				
Bonga Pump 1 to 3	3	5	5	8
Solana - Tuguegarao	8	12	12	
Angat - Maasim (Angat Maasim River Irrigation System)	3	5	5	6
Libmanan - Cabusao	6	6		
Gravity				
UPRIIS	2.5	3.5	3.5	6
Other national irrigation systems	2	3	3	3
Communal				1.5[d]

[a]One cavan of unmilled rice weighs 50 kilograms at 14 percent moisture content.

[b]Irrigation fee rates for crops other than rice and annual crops are 60 percent of those for rice.

[c]Annual crops include bananas and sugarcane.

[d]Average annual amortization rate per hectare for all communal irrigation systems constructed by NIA or its predecessor agencies.

Notes:

1. Irrigation fees for pump irrigation systems differ due to costs of power which vary according to the source (i.e., National Power Corporation, electric cooperatives, private franchise holders, etc.).
2. The area (in hectares) planted to other crops in the National Irrigation Administration is a very small proportion of the total irrigated area. In 1982, out of 513,926 ha irrigated by the national irrigation systems, only 2,819 ha was planted to other crops. The current government programs on crop diversification can be expected to increase the area planted to other crops in the future.
3. World Bank-assisted systems are authorized to charge 7.9 cavans per double-cropped hectare within five years of system completion.

Source: National Irrigation Administration 1985a.

Assessment, billing, and collection procedures. NIA's standard operating procedures on billing and collection of irrigation fees are based on its Memorandum Circular (National Irrigation Administration 1970), and subsequent modifications to it. The key personnel involved in the assessment, billing, and collection process are the water master, the billing clerk, the irrigation superintendent, and the field cashier or collection officer.

Every week during the crop season, the NIA water master prepares a list of irrigated and planted areas. This list is prepared in triplicate, with the original going to the billing clerk and a copy each to

Next >>

the irrigation superintendent and the regional irrigation director. This weekly list has the acknowledgements of water delivery by the water users, or, if this acknowledgement has not been obtained, the certification of delivery by the water master.

The billing clerk prepares the bills for each lot, based on this list. The bills are not distributed or posted in the irrigation fee register, however, until receipt of the list of lots with total crop failure due to water shortage. Total crop failure is defined to mean a condition where the standing crop has been damaged to such an extent that practically no harvest is expected. The water master, in coordination with the local farm management technician of the Bureau of Agriculture or the Bureau of Plant Industry determines which lots have total crop failure due to water shortage, and prepares the list of such lots for submission to the irrigation superintendent three weeks before the estimated harvest date. Based on this list, the superintendent advises the billing clerk of cancellations and adjustments in fees, who in turn, adjusts or cancels the bills which he had previously prepared on the basis of the list of irrigated and planted areas.

The collection officer checks and verifies the bills against these two kinds of lists before forwarding them to the irrigation superintendent for his approval and signature. The bills are grouped by division for speedy distribution to the irrigation water users by the team leader for the division. The team leader must serve all bills before or during the threshing period, and obtain acknowledgements to the effect that all water users received their bills.

The bill collector or assistant collector has custody and accountability for official receipt booklets. He also receives payments that are due to NIA, and issues official receipts for all payments received. He turns over all collections to the field cashier, once a week, or whenever collections reach P500. The field cashier or collecting officer deposits the money with the Philippine National Bank branch in the locality, which remits the amount to the NIA central account with the bank's head office in Manila.

Enforcement. There is general agreement in the literature reviewed that the enforcement of punishment to nonpaying farmers has been problematic. For example, the nondelivery of water to delinquent farmers has not been enforced due to lack of water control devices in the field. Nondelivery of water to a section of a system, which would penalize a group of farmers who do not meet a certain collection level, may be easier to implement than preventing a particular farmer from having access to the irrigation water. In the case of pump irrigation systems, NIA may decide not to operate a pump if the fee collections amount to less than 90 percent of what is collectible. However, in the few instances where NIA decided to terminate the operation of a pump, local and provincial officials intervened on behalf of the farmers.

Given the difficulty of enforcing the payment of irrigation service fees through penalties, NIA has concentrated on providing positive incentives to encourage payment. Several approaches have been tried in various irrigation systems, on an experimental basis. These approaches generally combine delegation of certain O&M responsibilities to farmers' organizations, with incentives for them to take an active role in fee collection. For example, under one type of arrangement known as the "lateral turnover" arrangement, the farmers' association contracts with NIA for canal maintenance at a

specified rate per kilometer of canal. To the extent that the work can be done at a lower cash cost (by encouraging farmers to contribute unpaid labor) the association is able to earn a cash income. Furthermore, the association is allowed to retain 2.5 percent of the fees it collects from its members if it achieves a target rate of 70 percent collection. If the collection rate rises to 100 percent, the association can retain 3 percent of the collections (Cruz and Siy 1985). Under another arrangement, the farmers' association is given full responsibility for system maintenance without any cash payment. However, the association is allowed to retain a significant portion of the irrigation service fees it collects from its members. For collections below 50 percent of the aggregate amount due, the association is allowed to retain 35 percent of the funds collected. For all collections above 50 percent, the association is allowed to retain 65 percent of the amounts collected (Cruz and Siy 1985). NIA also provides an incentive for prompt payment by giving a 10 percent discount to farmers who pay 100 percent of their current account collectibles on time (Cablayan and Palomares 1986, Cruz 1979).

Collection Efficiencies

National irrigation systems. The irrigation fee collectibles and actual collections in all national irrigation systems from 1971 through 1984 are given in Table 5.26. Collections from current accounts averaged only about 37 percent, while those from back accounts averaged 5 percent. Data are unavailable on the age of both the uncollected and collected back accounts. It seems likely, however, that most collections on back accounts are for relatively recent billings. Assuming that all collections on back accounts are from the previous year's billings, the data from Table 5.26 have been used to estimate the total collections from each year's billings (Table 5.27).

Table 5.26. Irrigation fee collectibles and actual collections in all national irrigation systems.

Year	Collectibles ('000 pesos)			Collections					
				From current account		From back account		Total collections	
	Current charges	Back account	Total	'000 pesos	Percent	'000 pesos	Percent	'000 pesos	% of current account
1971-1972	10749	46383	57132	4281	39.8	2114	4.6	6395	59.6
1972-1973	12174	50737	62911	5052	41.5	2807	5.5	7859	64.6
1973-1974	16387	55052	71439	6025	36.8	3266	5.9	9291	56.7
1974-1975	17538	62156	79694	7162	40.8	3152	5.1	10314	58.8
1975-1976	49716	69382	119098	13434	27.0	2199	3.2	15633	31.4
1977	85396	130318	215714	27733	32.5	10278	7.9	38011	44.5
1978	85015	175208	260223	30316	35.7	11693	6.7	42009	49.4
1979	112754	227407	340161	35553	31.5	11229	4.9	46782	41.5
1980	97039	293537	390576	37154	38.3	14522	5.0	51676	53.3
1981	130483	314345	444828	46451	35.6	12124	3.9	58575	44.9
1982	120207	385660	505867	43101	35.9	15329	4.0	58427	48.6
1983	118425	432433	550858	56775	47.9	15788	3.7	72563	61.3
1984	158675	487269	645944	77648	48.9	23152	4.8	100800	63.5

Source: National Irrigation Administration Collection Efficiency Report (1985).

Table 5.27. Estimated collection efficiencies from current irrigation service fee charges.

Year of billing	Current charges	Amount of current charges collected		Percent of current charges collected			Percent of total collections received in year of billing
		In year of billing	In following year	In year of billing	In following year	Total	
1971-1972	10749	4281	2807	39.8	26.1	65.9	60.4
1972-1973	12174	5052	3266	41.5	26.8	68.3	60.8
1973-1974	16307	6025	3152	36.9	19.3	56.3	65.6
1974-1975	17538	7162	2199	40.8	12.5	53.4	76.4
1975-1976	49716	13434	10278	27.0	20.7	47.7	56.6
1977	85396	27733	11693	32.5	13.7	46.2	70.3
1978	85015	30316	11229	35.7	13.2	48.9	73.0
1979	112754	35553	14522	31.5	12.9	44.4	70.9
1980	97039	37154	12124	38.3	12.5	50.8	75.4
1981	130483	46451	15329	35.6	11.7	47.3	75.2
1982	120207	43101	15788	35.9	13.1	49.0	73.3
1983	118425	56775	23152	47.9	19.5	67.5	71.70

Source: Calculated from Table 5.26, assuming all back account collections are from the previous year's billings.

The data in Table 5.27 indicate a gradual decline in the total collections as a percentage of the amounts billed from the early 1970s until about 1979, followed by a gradual increase. Of the total amounts collected from each year's billings, generally from 65-75 percent has been collected in the year of the billing, with the remaining 25-35 percent collected in the following year. The major exception to this occurred in 1975-1976, when NIA introduced an approximately four-fold increase in the rates charged — the first increase in a decade (see Table 5.23). Collections during that year dropped to a record low of 27 percent of the billings. This has sometimes been cited as evidence that many farmers refused to pay these higher fees. But the apparent amount of these charges collected in the subsequent year was very high, comprising another 21 percent of the amounts billed. This suggests that the impact of the increase in the fees was more an initial delay in payments than a sharp decrease in the total level of payments. Total payments on that year's billings are thus estimated to be about 48 percent, which was somewhat lower than in the previous year, but quite consistent with the downward trend that had been taking place over several years.

At present, NIA is in the process of reviewing the back accounts to consider the possibility of deleting them from its books. But in order not to set a precedent on bad debts, a method of writing-off back accounts in proportion to improvements in total collections of current accounts is being formulated. Writing-off all, or a portion of farmers' back accounts could strengthen their willingness to pay their current accounts. A NIA study on 18 selected irrigation systems reported that on the average, farmers are willing to pay up to 71 percent of their back accounts on an installment basis (National Irrigation Administration 1984c). NIA's course of action on these accounts must take into consideration the related rules and regulations being implemented by the Bureau of Internal Revenue.

NIA's program of involving farmers' irrigation associations in the collection of irrigation fees may increase its collection efficiency. A case study on the Angat-Maasim River Irrigation System showed a 15 percent increase in the collection of irrigation fees after the formation of the farmers' association (National Irrigation Administration 1983).

A feasibility study conducted by Japan International Cooperation Agency (1984) on the improvement of O&M of the UPRIIS reported an average irrigation service fee collection efficiency rate of about 50 percent from 1979 through 1982 for the system (Table 5.28). The efficiency rate in the UPRIIS is lower than the average collection efficiency in all national irrigation systems, which stands at about 60 percent. The low collection efficiency is attributed to: a) insufficient supply and improper distribution of irrigation water, b) inadequate records and complicated billing and collection procedures, c) lack of dissemination, d) low capacity of the farmers to pay, e) farmers' negative perception of the quality of irrigation services, and f) absence of effective measures to punish nonpaying farmers.

Table 5.28. Irrigation service fee collections, UPRIIS, 1979-1982.

District	Collectible ('000 pesos)	Collections[a] ('000 pesos)	Efficiency (percentage)
1979			
1	6452	3294	51.1
2	7800	4997	64.1
3	8964	4086	45.6
4	5512	3543	64.3
Whole UPRIIS	28728	15920	55.4
1980			
1	5760	2967	51.5
2	6759	4407	65.2
3	7427	3559	47.9
4	5330	2534	47.5
Whole UPRIIS	25276	13467	53.3
1981			
1	8394	3842	45.8
2	9350	4254	45.5
3	10571	3509	33.2
4	6129	3814	62.2
Whole UPRIIS	34444	15419	44.8
1982			
1	8263	3932	47.5
2	9389	4944	52.7
3	10166	3769	37.1
4	7127	4689	65.8
Whole UPRIIS	34945	17334	49.6
Average collection and efficiency (1979-1982)		15535	50.4

[a]Including back account.

Source: Japan International Cooperation Agency (1984).

The above study recommends: a) that water users' associations collect irrigation service fees and remit the collections to the UPRIIS office, in order to alleviate the burden on the office of collecting directly from individual farmers; b) that the option to pay irrigation fees in-kind be abolished, or the allowance of 6 kg/cavan collected for payments in-kind be increased to 10 kg/cavan to recoup all expenses incurred in collecting the rice; and c) that the present penalty charge of one percent per month for nonpayment of the irrigation fees be increased, considering the current interest rates on loans and penalties on tax payments.

Of critical concern to NIA is the balance between the revenues it receives in the form of irrigation service fees that are collected and the expenditures it incurs for O&M. Average aggregate data on this balance, based on systems-level O&M expenditures, are presented in Table 5.29. Irrigation service fee collections were equivalent to nearly 70 percent of the O&M costs in 1979 and 1980, but dropped to only 50 percent in 1981 when O&M expenditures increased sharply, while collections declined somewhat. In 1983 and 1984 collections rose more rapidly than O&M expenditures, so that nearly 75 percent of the O&M expenditures were covered by fee collections.

Table 5.29. Total irrigation service fee collections and O&M fund releases, 1979-1984.

Year	Total collections (in million pesos)		Fund releases (in million pesos)		Collections as a percent of releases
	Current pesos	1984 pesos[a]	Current pesos	1984 pesos[a]	
1979	45.35	104.31	66.15	152.16	68.6
1980	59.24	118.51	85.75	171.55	69.1
1981	52.74	95.42	103.45	187.17	51.0
1982	58.43	97.48	108.14	180.41	54.0
1983	72.72	108.57	100.99	150.78	72.0
1984	98.95	98.95	132.35	132.35	74.8

[a]Current pesos converted to 1984 pesos using Implicit GDP Deflator (Asian Development Bank 1985).
Source: National Irrigation Administration (1984b).

Similar data for 1982, broken down according to the 12 NIA regional offices, are presented in Table 5.7. There are sharp differences among regions in the extent to which irrigation service fee collections cover O&M expenditures. Ignoring Region 7, which has less than 500 ha of irrigated area, the range is from 41 percent in Region 5 to 164 percent in Region 10. The variability is only partly accounted for by variation in collection efficiencies, whose range was 50-81 percent. It is clear that the O&M cost per hectare is much more variable than the irrigation service fee per hectare. The correlation coefficient between average O&M expenditures per hectare and the average irrigation fee charged per hectare is only 0.30. Even excluding Region 7, the correlation coefficient is only 0.59. Thus, in some regions farmers are asked to pay considerably more than the total O&M expenditures, while in other regions they are asked to pay an amount approximately equal to or less than O&M expenditures. At the national level, the average irrigation service fee which farmers were asked to pay in 1984 was about 20 percent greater than the O&M expenditures per hectare.

Similar data, again for 1982, for the 12 individual systems comprising Region 3 (which accounts for about one-third of the total area of national irrigation systems) are presented in Table 5.8. The range of collection efficiencies was 41-91 percent, with an average (dominated by the UPRIIS collection efficiency of 50 percent) of 54 percent. Variability among these systems in the extent to which collections cover O&M expenditures is less than that among the 12 regions of the country. The correlation between the fees charged and the O&M expenditures incurred, both on a per hectare basis, is only 0.31 for the 12 systems, rising to 0.68, if the 2 systems with the smallest area (less than 100 ha in each case) are overlooked in the analysis. Ignoring the 4 systems with less than 600 ha each, the collections range from 62 percent of O&M expenditures to 79 percent. Average charges are about 28 percent greater than average O&M expenditures — a figure comparable to the national average — but with a lower average collection rate (54 percent); the collections for the entire region amount to only 69 percent of expenditures.

Total O&M releases in 1984 were P132.4 million (Table 5.29), and total current charges for irrigation service fees were P158.7 million (Table 5.26). This implies that an average collection efficiency of 83 percent would have been required for NIA to fully reover O&M costs and it estimates that in general, to recover O&M costs fully, the collection efficiency should be from 80-85 percent of the current amounts billed.[3]

Pump irrigation systems. Pump irrigation systems present a special problem because of their high operating costs. To some extent, this is reflected in the higher irrigation service fees that NIA charges farmers in these systems (Table 5.25). But these differences do not always fully reflect cost differences. For example, the Tibagan portion of the Angat-Maasim River Irrigation System incurs power consumption costs of nearly P1,200/ha (Table 5.11). Given the irrigation service fee rates for this system (Table 5.25), and assuming 80 and 60 percent of the service area to be planted during the wet and dry seasons respectively, with no third cropping, the total fees assessed would amount to only 78 percent of the cost of power consumption. In contrast, NIA could cover its O&M costs with only a 50 percent collection rate for the Libmanan-Cabusao pump irrigation systems, and with an 87 percent rate for the Bonga pumps. Although there is little difference in the O&M cost per hectare for the Libmanan-Cabusao and the Bonga pumps, the latter system has a maximum irrigation service fee of 8 cavans (400 kg) for the wet and dry seasons, as compared to the 12 cavans (600 kg) for the 2 seasons in the case of Libmanan-Cabusao pump irrigation systems. For the Solana-Tuguegarao pump irrigation systems, in spite of an irrigation service fee of 20 cavans (1,000 kg) for the wet and dry seasons, a collection efficiency of 77 percent would be needed just to cover the costs of power.

[3]Although the rate of collection on current billings is important, another potentially significant factor is the extent to which billings are issued to irrigated areas. Data from Table 9 show the 1984 "irrigated area" (as contrasted to the larger service area) to be 421,200 ha in the wet season, and 267,600 ha in the dry season. Using P223/ha as the wet season fee (100 kg rice at the official price of P2.23/kg) and P334.5/ha as the dry season fee, the implied total billings would be P183.4 million. Actual billings, as reported in Table 25, were only P158.7 million, or 87 percent of this amount. Considering that the wet and dry season fee rates in the Upper Pampanga River Integrated Irrigation System, which comprises 19 percent of the total service area of the country, are 25 and 17 percent greater, respectively, than the rates used in the above calculation, it appears that either a) data on irrigated areas are considerably overstated, b) billing adjustments for crop damage are high, or c) many farmers in irrigated areas are not billed. To the extent that the latter is the case, the National Irrigation Administration could improve its financial position by improving its rate of billing coverage.

Improvement of collection efficiency. In 1977, a study was launched by NIA to identify and quantify the variables affecting collection efficiency. The study was formulated based on the concept that collection efficiency is affected by variables associated with NIA organization and with the farmer-clientele. Results of the analysis of the information obtained from 30 sample irrigation systems from Luzon revealed the following factors that directly affect collection efficiency: adequacy of personnel and budget, communication among personnel and with farmers, capacity of the irrigation system to perform adequately, and performance evaluation. The discrepancy between the area programmed for irrigation and those actually served explained about 31 percent of the variations in collection efficiency.

Based on the above study, NIA developed a Management Action Program in 1980 which defines the direction of its efforts in improving collection activities. This program identified the presence of a strong collection base, a credible package of rewards and punishment, and a practical and efficient billing and collection machinery as the three basic requisites for a good collection system. In essence, the program aims to strengthen the collection base by increasing the reliability of NIA service delivery, thus making the clientele capable and willing to pay their obligations. A package of rewards and punishments is designed to provide incentives for farmers to pay, and to prevent nonpaying farmers from continuing their practice. A practical, simple, and efficient billing and collection machinery is also intended to lend itself to easy monitoring and checking for both accomplishments and discrepancies. While the plan to implement initially this program in the Angat-Maasim River Irrigation System on a pilot basis did not materialize, a number of the recommended actions in the program have been adopted by management for implementation.

For pump irrigation systems, NIA launched the Farmer Irrigator Organizing Project in 1982 with the farmers themselves as organizers. The main goals of this Project are to reduce O&M costs and to increase rates of irrigation service fee collection. Reduction in O&M costs was expected to be effected by the Irrigators' Association doing the O&M work of cleaning canals, distributing irrigation water, and collecting irrigation service fees. The NIA management decided to carry out a pilot implementation of the Farmer Irrigator Organizing Project in some selected areas of the Angat-Maasim River Irrigation System and PGRIS. These areas involved pump irrigation systems where the funds collected from irrigation service fees were 33 percent below O&M expenses.

The status report and impact assessment of the Farmer Irrigator Organizing Project after a 20-month implementation period showed that cropping intensities of areas in this Project increased from 157 percent in 1982 to 175 percent in 1984. Collection efficiency increased from 56 percent in 1982 to 71 percent in 1984. Aggregate O&M expenses in the Project areas declined by about 18 percent. These changes resulted in these areas being transformed from a nonviable status (0.61 viability index in 1982), to a viable status (1.32 viability index in 1982)[4].

[4]The viability index combines information on the performance of the system in terms of cropping intensity for the area programmed for irrigation with information on actual physical accomplishments relative to planned accomplishments.

Four Irrigators' Associations in pump irrigation systems have entered into contracts with NIA for the assumption of O&M responsibilities. Three types of contractual arrangements have emerged:

a) The association assumes full responsibility for the system's O&M, including maintenance, water distribution, and fee collection activities, and shoulders the corresponding O&M expenses such as power cost, transmission line maintenance cost, salaries, wages of the pump operator, and others. In addition, the association gives NIA a token payment of 25 kg (1/2 cavan) of rice per hectare per year for 25 years.

b) The association participates in all O&M activities. O&M expenses are subtracted from the total fees collected, and any excess is shared equally by NIA and the irrigators' association. If there is a deficit, the fee for the subsequent cropping seasons is adjusted accordingly.

c) Another joint management contract formulated quite differently is one where a fixed rate of P92/ha/season is charged by NIA to cover O&M expenses. If the total fee collection exceeds this amount, the excess income is shared equally between NIA and the association. If there is a deficit the association undertakes to reimburse NIA for the deficit.

Collection costs. The total expenses incurred in the collection of irrigation fees from 1982-1985 in national irrigation systems are given in Table 5.30. The expenses incurred on a per hectare basis have increased by 27 percent over the past four years. This collection expense of about P14/ha of service area (or P18/ha irrigated) is roughly 8 percent of the average collections in 1984 (see Table 5.29), and 5 percent of the average assessment (see Table 5.26).

Table 5.30. Total expenses incurred in the collection of irrigation fees in national irrigation systems, 1982-1985.

Year	Collection expenses ('000 pesos)	Incentives/ bonuses ('000 pesos)	Personnel expenses[a] ('000 pesos)	Total expenses	
				('000 pesos)	(P/ha)
1982	1169	335	3936	5440	11
1983	1944	680	4282	6905	13
1984	2549	793	4358	7700	14
1985[b]	2421	869	4358	7648	14

[a]Personnel expenses are based on a personnel density of one billing clerk per 3,700 ha of service area and one bill collector per 7,400 ha of service area, both with an average gross salary of P1,600 per month, 1982-85.

[b]Based on the estimated budget for 1985 and the same service area as in 1984.

Source: National Irrigation Administration (1985a).

Personnel expenses average about 60 percent of the total collection expenses incurred. Though the salaries of the water management technicians and ditchtenders deputized to collect irrigation fees are not included under personnel expenses, the incentives and bonuses they received are included.

Indirect Methods

Secondary income of NIA. Income earned by an irrigation agency from sources other than charges paid by the water users may be termed secondary income. NIA earns secondary income from equipment rental, from interest on construction funds held on deposit, and from management fees which it charges to supervise construction of foreign-funded systems. The total amount of such income greatly exceeds the revenues derived from irrigation service fees (Table 5.31); however, much of this income is derived from, and spent on, new construction, and is therefore not available to finance O&M expenditures. The approximate percentage of O&M expenditures financed by irrigation service fee collections was 54 percent in 1982, 72 percent in 1983 and 75 percent in 1984 (Table 5.29). By implication, the remaining portions were financed from NIA's secondary income.

Table 5.31. Income of the National Irrigation Administration by source, 1983 and 1984.

Source	1983		1984	
	Million pesos	Percent total	Million pesos	Percent total
Irrigation service fees	72.7	22.2	100.8	23.3
Other operating and service income	134.5	41.0	128.6	29.7
Income from investments	98.3	30.0	175.9	40.7
Miscellaneous income	12.6	3.8	11.1	2.6
Sale of assets	9.6	2.9	8.9	2.1
Grants	0.3	0.1	7.1	1.6
Total	328.0	100.0	432.4	100.0

Source: Japan International Cooperation Agency (1984), Annual Audit Report on NIA for 1984.

Real property taxation. Local governments in the provinces, cities, and municipalities receive a significant portion of their fund requirements and operational needs from the real property tax which they are permitted to levy. This tax is imposed on all real property including land, building, machinery, and other improvements attached or affixed to real property. The real property tax is an *ad valorem* tax based on the value of the property. Real property is classified for assessment purposes on the basis of actual use. A percentage assessment level is applied to the market value to determine the taxable or assessed value of the property. The market values used for assessment purposes are supposed to be revised every three years.

In addition to the basic real property tax, there are special levies on real property. The Real Property Tax Code authorizes the imposition and collection of the following:

a) a one percent annual real property tax for the Special Education Fund created under Republic Act No. 5447;

b) an *ad valorem* tax on idle lands at the rate of five percent per year based on the assessed value of the property;

c) a special levy on lands benefited by public improvements financed by local governments, not exceeding 60 percent of the costs of these improvements; and

d) a special levy on lands benefited by public works projects financed by the national government, not exceeding 60 percent of their cost. The national government, through the Minister of Finance may, by Ministry Order issued for the purpose, provide for the imposition and collection of this special levy. In this case, however, the tax shall be collected by the local government treasurers who shall remit their collections to the national treasurer in accordance with the rules and regulations issued by the Minister of Finance for its implementation.

Detailed data to permit an evaluation of the extent to which irrigation has increased revenues derived from property taxes are not available; however, data on the valuation of irrigated and nonirrigated rice land in several municipalities in four provinces suggest that the impact of irrigation on these revenues is very low. The range of the difference in the reported market values between irrigated and nonirrigated land was P500-8,000/ha. Considering that assessed values of agricultural land are only 40 percent of the market values, and that the maximum tax rate is 0.5 percent of the assessed value, the implied maximum increase in regular property tax revenues due to irrigation is only between P1.0 and P16.0/ha per year. The provision for the imposition of an additional tax (effectively a betterment levy) through the "special levy on lands especially benefited by public works projects" is a possible alternative method that could be used to recover some of the investment cost of irrigation infrastructure. It is not clear whether this type of tax has ever been imposed on newly irrigated areas.

Taxes on Business

There are a number of national and local business taxes which may increase due to the increased volume of business activity resulting from the additional production brought about by irrigation; however, it would be very difficult to quantify the effect of irrigation on these tax revenues. Grain wholesalers, retailers, and millers have to pay a tax based on their gross annual sales during the preceding year. Operators or owners of rice or corn mills are also subjected to an annual graduated fixed tax based on total capacity per machine. In addition, the National Food Authority requires payment of application, license, and registration fees for the following activities in the grains industry: retailing, wholesaling, threshing, corn shelling, processing and manufacturing, exporting, importing, indenting, warehousing, milling, and grains packaging.

RELATIVE CONTRIBUTION OF FARMERS TO IRRIGATION FINANCING

As has been indicated in previous sections of this report, the aggregate level of contribution of farmers to irrigation financing in national irrigation systems is less than the O&M costs. There is, thus, no aggregate contribution to the capital cost of irrigation. On the other hand, it has also been noted that there is considerable variability among regions of the country, and among individual systems, in the amount which farmers pay relative to the O&M costs. If one were to consider an analysis on a

system-by-system basis, one could conclude that in some systems farmers are paying for a portion of the capital costs. The implication of this, when combined with the fact that at the national level there is no aggregate farmer contribution to capital costs of irrigation, is that farmers in some irrigation systems effectively subsidize the O&M costs of other systems.

For communal irrigation systems, farmers and their organizations have complete physical and financial responsibility for O&M. In addition, they are required to make payments designed to recover, over a 50-year period at no interest, the portion of the capital cost that was provided by NIA for the initial construction of the facilities. This policy thus provides for the farmers of communal irrigation systems to make some contribution towards capital recovery, although the effective subsidy (through the long-term interest-free loan to the farmers) is high.

EVALUATION OF FINANCING POLICIES

Efficiency in Water Use

The methods of irrigation financing used in the Philippines provide virtually no direct incentives for individual farmers to increase their efficiency of water use. A possible exception involves the distinction that is made in the irrigation service fee between land cropped to rice and land producing other ("upland") crops. A farmer growing the latter pays only 60 percent of the fee charged from a farmer producing rice. Although this may have some effect on a farmer's cropping decision, the fact that there is almost no upland crop production within the Philippine irrigation systems suggests that now any efficiency effect that this policy may have is inconsequential.

Efficiency of water use in the Philippines is thus related more to the effectiveness of NIA's control over the distribution of the supply of water within the irrigation system than to the control over the individual farmer's demand for water through any pricing mechanism. In many systems, this control is problematic, and the resulting water use efficiencies are low.

Efficiency in Investment

Until recently, there was little in the financing policies of the Philippines that would enhance the efficiency of investment decisions. Such decisions were made as part of an overall planning process that was not directly concerned with the levels of farmer payments for irrigation services. This has recently changed, as NIA has been asked to assume responsibility for foreign loans for irrigation investments. Considering that NIA is still facing the problem of how to generate enough funds to cover O&M, it is not clear that imposing an additional financial responsibility for capital investments would improve the quality of the investment decisions. It is possible that the result would be to encourage NIA to avoid undertaking new projects which involve foreign loans, regardless of the inherent desirability of the proposed investments. Such a response was considered in the analysis undertaken for the NIA Corporate Planning study (National Irrigation Administration 1984a). That analysis concluded, however, that the gains from such a strategy, in terms of NIA's reduced foreign

loan repayment obligations, would be more than offset by the reduction in its income from the management fees that it charges on capital outlays for new projects. The fact that undertaking new system construction generates a source of income (the management fees) which can be used to cover deficits in O&M suggests that current financial policies may influence investment decisions in ways that have little relationship to the economic efficiency of the investment.

Efficiency in Management

Financing policies in the Philippines have put increasing pressure on NIA to reduce the deficit which it encounters in its operation of irrigation systems. From NIA's perspective, this can be done either by increasing revenues or by decreasing expenditures. Given that NIA has not followed the undesirable strategy of reducing expenditures by drastically curtailing services and letting irrigation systems deteriorate, most of the options open to NIA involve placing greater responsibility on the farmers. This responsibility may be financial (increasing the rate of fee collection from farmers, or increasing the amount of the fees charged), or it may be physical (increasing the involvement of farmers in the actual O&M activities). NIA has followed both approaches, and in doing so, has found it necessary to provide the farmers with incentives to cooperate. It is recognized, for example, that farmers are unwilling to take over the operation of a system that is in such poor condition that satisfactory operation is not possible. It is also recognized that if farmers are expected to pay their irrigation fees, NIA must provide a service which is satisfactory, not just from the perspective of NIA, but from that of the farmers. Furthermore, by turning over the operation of portions of the systems to the farmers, it is probable that the real costs of O&M have been decreased, as farmers are likely to be able to undertake these activities at a lower cost than NIA. Although difficult to quantify, it appears that these developments have generally led to increased efficiency of irrigation management.

Income Distribution between the Public and Private Sectors

Irrigation clearly involves a net expenditure of public funds in the Philippines, as it does in most countries. In effect, none of the capital costs of irrigation investments are recovered, with the exception of the communal irrigation systems.

There is also a deficit between the amount of funds collected directly from farmers and the amount of recurrent expenditures incurred for O&M. This deficit, however, is modest, and could be decreased significantly with increased collection efficiencies of the irrigation service fees. In addition to the direct contributions of farmers to O&M expenditures, there are other sources of government revenues which have been increased as a result of the economic activity generated by irrigation. These include a land tax and various business taxes and fees. Data are insufficient to quantify the importance which irrigation has had on the revenues generated from these taxes.

Income Distribution within the Private Sector

The general subsidy of the capital costs of irrigation, and some of the O&M costs represents a transfer of income from taxpayers to the farmers in irrigated areas. In general, this implies a redistribution of

income from the urban population to the farmers. This is consistent with the policy of the government to increase farm incomes, especially in the light of the disparity between farm incomes and average non-farm incomes. On the other hand, to the extent that the subsidy to farmers of irrigated land reduces the funds available to the government for other rural development activities, these farmers are benefiting at the expense of farmers in rain-fed areas. Furthermore, to the extent that government price policies for rice and for agricultural inputs other than water, discriminate against farmers, this subsidy offsets what would otherwise be an income distribution bias against farmers and toward the urban sector.

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Financing Irrigation Services in India: A Case Study of Bihar and Haryana States

Ramesh Bhatia

FINANCING IRRIGATION SERVICES IN INDIA: A CASE STUDY OF BIHAR AND HARYANA STATES

INTRODUCTION

For this study, the States of Bihar and Haryana in northern India have been selected for in-depth analysis of available data and evaluation of alternative policies for financing irrigation services. The irrigation systems in both States are characterized by a mix of century-old projects and new ones built in the last few years. Both States are in the Indo-Gangetic Plains of northern India. While Bihar, in the East, is known for its high water resource base (both groundwater and surface water) and its low utilization, Haryana is known to be nearing its limits in using available water resources. Per capita income in Bihar in 1980-81 was 35 percent lower than the all-India average; that of Haryana was higher than the country average. The economic development of Bihar has decelerated in the 1970s and the 1980s, compared with the 1960s, on account of a number of political, social, and economic factors. The economy of Haryana has been growing fast; an increase of 76 percent in state income (Net State Domestic Product) at constant prices over the decade 1973-74 to 1983-84. The per capita income, during the same period, rose from Rs 818 in 1973-74 to Rs 1,127 in 1983-84 (at constant prices) — an increase of 38 percent. Bihar is known for its high density of population, high unemployment levels, and a fast-expanding bureaucracy. Haryana is characterized by low density of population and by a more efficient bureaucratic setup (relative to Bihar). Hence, it was expected that an analysis of these two States would throw some light on different practices followed and the problems faced in the two environments.

India is a union of 23 Federal States and 8 Union Territories. The total geographical area of India is about 328 million hectares (ha). Though India is the seventh largest country in the world in terms of area, its population makes it the second most heavily populated country (after China) in the world.

Economic Development in India

India has adopted the path of planned economic development with the objectives of removing poverty, building a strong and self-reliant economy, and creating a social system based on equity and justice. The rate of growth of GDP has accelerated over the past decade or so, and the Sixth Plan (1980-85) target of aggregate growth of 5.2 percent has been achieved. The Seventh Five Year Plan (1985-90) has targeted growth of the economy at an average annual rate of 5 percent. The sectoral growth rates expected over the Seventh Plan are: 4 percent per annum for agricultural output; 8.3 percent per annum for mining and manufacturing; 12 percent per annum for electricity, gas and water supply; and 8 percent per annum for transport services. Agriculture, which accounted for 37 percent per annum of the National Income in 1984-85, is projected to contribute about 33 percent to

National Income in 1989-90. The Plan Outlay in the public sector during 1985-90 would be Rs 1,800 billion (approximately US$150 billion).[1] The share of major sectors in public sector outlays during the Seventh Plan is expected to be as follows: agriculture 6 percent, irrigation and flood control 9 percent, energy 30 percent, industry and minerals 12 percent, transport 13 percent, and social services 26 percent.

India's Gross National Product (GNP) at factor cost was Rs 1,884.6 billion (approximately US$157 billion) at current prices in 1984-85. At 1970-71 prices the GNP was Rs 612 billion (US$51 billion). Per capita Net National Product (NNP) in 1984-85 was Rs 2,343 (US$195) at current prices and Rs 772 (US$64) at 1970-71 prices. Annual growth rates for per capita income, at constant prices, have ranged from 1.1-2.9 percent during the 1970s to 0.2-5.5 percent during the 1980s. The index of industrial production (Base 1970 = 100) increased from 167.3 in 1981-82 to 194 in 1984-85. Gross domestic savings as a percentage of GDP increased from 16.8 in 1970-71 to 22.1 in 1984-85.

The all-India production of food grains increased from 121 million tons in 1975-76 to 146.2 million tons in 1984-85, i.e., an increase of 20.8 percent over the decade.[2] Index numbers (triennium ending 1969-70 = 100) in 1984-85 increased to 155 for agricultural production, 150 for rice, 245 for wheat, 110 for pulses, 146 for sugarcane, and 303 for potato. The trend in growth rate of production of food grains from 1954-1985 has been 2.7 percent per annum, slightly higher than the population growth rate. The average yield rate (kilograms/ha) for rice increased from 1,123 in 1970-71 to 1,425 in 1984-85; wheat from 1,307 to 1,873; and potato from 9,976 to 14,815. In this same period the total irrigated area (cumulative utilization) increased from 38 to 61 million ha; total consumption of chemical fertilizers (in NPK, i.e., nitrogen, phosphorus, potassium) from 2.18 to 9.55 million tons; and total area under high yielding varieties (HYV) from 15 to 62 million ha, respectively. In 1984-85 almost 60 percent of the total area under rice and 83 percent of the total area under wheat were under HYV seeds. Similarly, in 1982-83, 42 percent of the total area under rice, 72 percent of the total area under wheat, and 79 percent of the total area under sugarcane were irrigated.

The area under irrigation increased at the rate of 0.7 million ha/year during the First Plan period (1951-56), and the growth rate accelerated to 1.6 and 2.2 million ha/year during the Fifth and Sixth Plan years, respectively.[3] Table 6.1 gives data on ultimate irrigation potential, potential created, and potential utilized for surface and groundwater resources. Out of an area of about 304 million ha, net sown area was estimated in 1980-81 at 140 million ha and gross cropped area at 173 million ha. The ultimate irrigation potential from major, medium and minor irrigation schemes is estimated at 113.5 million ha. Of this, 58.5 million ha is from major and medium schemes (surface water), 15 million ha from minor surface water schemes, and 40 million ha from minor groundwater schemes.[4]

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[1]For details, see Government of India: Seventh Five Year Plan; Economic Survey 1985-86.

[2]For details, see Economic Survey 1985-86; Government of India.

[3]For details, see the Seventh Five Year Plan, p.72.

[4]According to the classification adopted in 1978, projects having a Culturable Command Area (CCA) of more than 10,000 ha each are classified as major schemes while those having a CCA of 2,000-10,000 ha each and those having a CCA of less than 2,000 ha each are classified as medium and minor schmes, respectively.

Table 6.1. Irrigation potential and utilization in India, Bihar, and Haryana (million ha).

		Ultimate potential			Potential created/utilized		
		All India	Bihar	Haryana	All India	Bihar	Haryana
1.	Surface water	73.5	8.4	3.1	40.2 (85)	4.0 n.a.	2.0
	- major & medium	58.5	6.5	3.0	30.5 (83)	2.8 (76)	2.0
	- minor	15.0	1.9	0.1	9.7 (93)	1.2 n.a.	a
2.	Groundwater	40.0	4.0	1.5	27.7 (94)	2.1	1.4
	Total	113.5	12.4	4.6	67.9 (89)	6.1	3.4

[a]Negligible.

Notes: 1. Figures in parentheses give percentage of potential that has been utilized.
2. Data for Haryana are for gross irrigated area from canals in 1983-84 in the case of major, medium, & minor projects.

Sources: Seventh Five Year Plan, p. 72
Central Water Commission (1982)
Government of Bihar, Irrigation Department

A Comparative Profile of Bihar and Haryana

Table 6.2 gives some data on demographic and other variables for Bihar, Haryana, and all-India. According to this profile, Bihar can be seen as a heavily populated, rural State with a low per capita income. In Bihar, 32 percent of the gross cropped area is irrigated, compared with 58 percent for Haryana. In 1975-76, the per capita income in Bihar of Rs 661 (at current prices) was 35 percent lower than the all-India average. The per capita income in Haryana for the same year was Rs 1,333, about 30 percent higher than the all-India figure. By 1980-81, the relative position of Bihar had worsened when at Rs 870, it was only 57 percent of the all-India figure of Rs 1,537 at current prices. The per capita income of Haryana was Rs 2,331 in 1980-81, 52 percent above the all-India average.

Table 6.2. A comparative profile of India, Bihar, and Haryana (1980-81).

Item	Unit	All-India	Bihar	Haryana
Area	000 sq km	3183 (100%)	174 (5.3%)	44 (1.38%)
Population (1981)	million	684.0 (100%)	69.8 (10.2%)	12.9 (1.9%)
Population growth rate (1971-81)	%	2.5	2.4	2.9
Rural population	%	76.3	87.6	78.1
Ratio of agricultural workers to rural population	%	28.2	26.8	5.8
Population density	person per sq km	212	402	291
Number of towns	no.		161	84
Number of villages (approximately)	thousands	576 (100%)	77.959 (13.5%)	7.604 (1.3%)
Average size of land holdings	ha	2.0	1.11	3.58
Total geographical area	million ha	304	17.3	4.4
Net area sown	million ha	140	8.3	3.6
Total cropped area	million ha	173	11.1	5.5
Intensity of cropping	percentage	124	134	153
Net irrigated area (total)	million ha	38.8	3.0	2.1
Net irrigated area by canals	million ha	15.3	1.2	1.2
Net irrigated area by tube wells	million ha	9.5	0.8	0.9
Gross irrigated area	million ha	49.6	3.6	3.3
Per capita income (current prices)	Rs	1537	870	2331

Source: See Appendix Tables.

The total production of food grain in Bihar increased from 9.2 million tons in 1975-76 to 10.32 million tons in 1984-85, an increase of 12.2 percent over the decade. The corresponding figures for Haryana are 5.0 million tons to 6.8 million tons, i.e., an increase of 36 percent.

Irrigation development in Bihar. Before 1951, there was only one major scheme, the Sone Canal Irrigation System. The irrigation development achieved by 1951 from major and medium schemes was 0.4 million ha. In the year 1968, a new barrage was commissioned at Inderpuri, eight kilometers (km) upstream of the old anicut (diversion). The new barrage supplies water through newly constructed canals into eastern and western low level canals.

After the start of planned development, 19 major and 86 medium schemes were taken up from 1951 to 1980. During the Sixth Plan, an outlay of Rs 8,500 million was provided to create an additional potential of 665,000 ha (i.e., Rs 12,800/ha). There were 42 major and 87 medium schemes during the Sixth Plan, in addition to 10 modernization schemes.

According to the Central Water Commission, the cumulative potential created by major and medium schemes by 1981 was to be increased to 2.532 million ha. Estimated utilization was only 1.8 million ha, while the actual area irrigated by canals (as reported by the Irrigation Department) was 1.2 million ha. The cumulative expenditure was estimated at Rs 7,640 million, i.e., an estimate of Rs 3,020/ha of potential created and Rs 4,440/ha of potential used. Table 6.3 gives details of capital costs of some major projects.

Table 6.3. Capital costs and potential created of a number of major irrigation projects in Bihar.

Name of the project	Year of completion (period of construction)	Estimated cost/outlays (Rs million)	Ultimate potential ('000 ha)	Potential created by June 80 ('000 ha)	Potential utilized by June 80 ('000 ha)	Capital cost/ha of ultimate potential
Kosi Barrage	1962-63 (57-58 to 62-63)	456[a]	-	-	-	[a]
Eastern Kosi Canal	1985 (1957-58)	1224[b]	434	342	185	3048
Rajpur Canal	1985 (1961-85)	1105	125	123	n.a.	6905
Western Kosi Canal	1987 (1971-87)	1560	314	Nil	n.a.	5131
Gandak[c]	1964-1985	4160	1710	n.a.	n.a.	2433
Subarnarekha	1983-1990	4810	200	-	-	24050
North Koel Reservoir	1978-	1140	131	-	-	8702
Sone Modernization (Phase I)	1985-1990	2470	-	-	-	-

[a]The cost of the Kosi Barrage has been allocated to the three canal systems on the basis of ultimate potential, i.e., Rs 228 million for Eastern Kosi; Rs 65 million for Rajpur Canal and Rs 163 million for Western Kosi Canal.

[b]Although the estimated cost was Rs 1,041 million, the expenditures incurred have been: Rs 991 million up to 1980-81; Rs 110 million during 1981-82 and the Sixth Plan outlay of Rs 579 million.

[c]The cost of a hydro-electric power plant of 7,500 kw in Nepal has not been excluded which may be approximately Rs 60 million.

Source: Central Water Commission: Report on the Status of Irrigation Development in India, 1981, New Delhi.

Irrigation development in Haryana. Before 1951, the only main project existing in the State was the Western Yamuna Canal System, one of the oldest canal systems in the country. The irrigation development from preplan major and medium schemes was 0.44 million ha. The new State of Haryana came into existence on 1 November 1966, after the bifurcation of the erstwhile State of Punjab. One major scheme undertaken during 1951-64 was the Bhakra-Nangal Project (portion in Haryana) which was completed in 1963-64, adding potential irrigation of 676,000 ha. Cumulative potential added from major and medium schemes up to 1980-81 was estimated at 1.785 million ha, while the cumulative utilization was estimated at 1.66 million ha. The outlays and potential created of some major and medium projects are given in Table 6.4.

Table 6.4. Capital costs of major and medium irrigation projects in Haryana.

	Potential created ('000 ha)	Potential utilized ('000 ha)	Expenditure (total) (Rs million)	Expenditure (Rs/ha) potential created
During Fifth Five Year Plan (1973-78)	181	37	1100	6074
Sixth Plan (1980-85)				
Major schemes (ongoing)	74	-	1845	24930
Medium schemes (ongoing)	11	-	58	5272
Major schemes (new)	27	-	400	14810
- Nehru Lift Irrigation Scheme	155	-	943	6084
- Laharu Lift Irrigation Scheme	66	-	300	4545
- Sewani Lift Irrigation Scheme	46	-	221	4800
- Sutlej-Yamuna Link	275	-	1010	3675
Total of all major & medium schemes	998	-	3958	3966

Source: Central Water Commission, Government of India: Report on the Status of Irrigation Development in India, 1981.

GENERAL POLICIES REGARDING IRRIGATION FINANCING

Historically, in India, two contradictory positions have been taken with respect to the levels at which water rates are fixed (Ansari 1968). The Planning Commission has emphasized the need for raising rates so as to augment irrigation revenues. Certain academic and even certain official and semiofficial circles, on the other hand, argued that the level of irrigation charges should be kept low even if this implies that full irrigation costs may not necessarily be recouped. Two major arguments are advanced

for assessing charges which do not cover costs. First, because the benefits of investment in major irrigation projects are spread over a wide range of people, with some people realizing direct benefits and others only indirect benefits, the full recoupment of costs from direct beneficiaries may not be justified.[5] If appropriate charges can be levied on the indirect beneficiaries, irrigation can still be a paying proposition. If, however, the indirect benefits are in part or wholly not chargeable, there would seem to be a case for the State's subsidizing of irrigation in the overall social interest.

Second, water rates should be kept low so that farmers are motivated to exploit the full irrigation potential. This argument implies that under-utilization of irrigation potential (of major projects) is due to high water rates. Therefore, by lowering rates better utilization can be achieved. Against this argument, it is generally contended that low water rates result in overirrigation and/or wastage of water. Besides, lower water rates for crops which are irrigation-intensive (e.g., rice, sugarcane) relative to those which are not (e.g., wheat, sorghum, millet) would result in the use of irrigation for crops which need not be optimum from the view point of society.

Thus, the level of water rates has to be determined not only from the narrow viewpoint of an accountant for whom cost recovery and financial returns are objectives in themselves. The level of, and changes in, water rates have to be related to the benefits obtained from the use of irrigation, and have to be considered in the context of overall macro policies relating to agricultural prices, input pricing, trade policies and tax or subsidy policies.

According to the Irrigation Commission "from the irrigator's point of view, therefore, water rates should be related to the benefit which irrigation confers rather than to the cost of irrigation projects" [Government of India 1972(1:268-269)]. Because irrigation requirements of crops vary according to season and region, the quantity of water supplied is also relevant in determining water rates. As irrigation projects differ widely in their capacity to meet the irrigation requirement of crops, adequacy and dependability of supply become important considerations in fixing irrigation rates. The Irrigation Commission came to the conclusion that "with so many considerations involved, there can be no precise formula for fixation of water rates, which must therefore remain a matter of administrative decision."

The Irrigation Commission recommended the following principles for guidance:

i) Water rates should be levied on a 'crop basis' except in the case of irrigation from tube wells;

ii) The rate should be related to the gross income from the crop and not to the cost of the project. It should range between 5-12 percent of gross income, the upper limit being applicable to each crop;[6]

[5]Indirect benefits arise from expanded business opportunities for agro-processing industries and form larger quantities of lower priced (than otherwise would have been possible) food available to urban consumers.

[6]As noted by the Irrigation Commission, (Government of India, 1972:268) "the value of irrigation water is the net gain which the farmer derives from its use. But irrigation is only one of the basic inputs used by a farmer and it is difficult to evaluate the precise contribution it makes to his net gain. In view of this difficulty, the Maharashtra Irrigation Commission (1960-62) had suggested that water rates on a crop basis should be fixed at 6-12 percent of the gross income, which is easier to calculate."

iii) The rates should be within the paying capacity of irrigators and should aim at ensuring full utilization of available supplies;

iv) Among regions with a similar class of supply, there should be the minimum disparity, if any, in the rates charged;

v) For fixing rates, irrigation should be divided into A, B, and C categories on the basis of the quantity and timeliness of supply. Lower rates may be fixed where, on account of good rainfall, the demand for irrigation water is less or where the supply is inadequate and uncertain; and

vi) The general level of rates in a State should be such that, taken as a whole, the irrigation schemes do not impose any burden on the general revenues.

The Irrigation Commission calculated the ratio of water rate to gross value of output for rice and wheat in a number of States (in the late sixties) and found that "the irrigation rates actually in force in different States are exceedingly low." For example, in Bihar, the water rate as a percentage of gross value of produce was 7 for rice and 2.7 for wheat. The corresponding figures for Haryana were 3.1 for rice and 1.1 for wheat.

Apart from raising water rates, the Government can also claim a share of the unearned increase in land values as a result of irrigation. All the States have enacted legislation for raising this levy which was determined by the difference between the market value of irrigated and nonirrigated land in the project area or in its vicinity. The Acts, however, have not been implemented by most of the States, and in some no assessment has been made, let alone any recovery. The main obstacle in enforcing the Betterment Levy Act has been the difficulty in assessing the increase in the value of land as a result of irrigation. It is contended that tenancy laws conferring permanent ownership rights upon tenants, and the implementation of other land reform measures, such as the abolition of intermediaries, fixation of fair rent, ceilings on land holdings, and regulation of transfer to prevent fragmentation of holdings, have all affected the market value of land. Hence, it becomes difficult to assess the increase in land prices attributable to irrigation [Government of India (1972:280)]. Apart from the procedural difficulties, implementation of a Betterment Levy is also constrained by the lack of political will in taxing better-off farmers.

CAPITAL COSTS OF IRRIGATION

Although much data on capital costs are available, the figures are not comparable across projects or states. This is because: a) irrigation projects differ in terms of type of structure (storage versus diversion), size of system, type of scheme (modernization scheme, gravity flow, or lift irrigation schemes) and the duration of construction; b) capital expenditures are incurred over a long period, sometimes over 15-20 years, and, on account of price changes in cost of materials and labor, the expenditures in different years cannot be added; and c) irrigation potential created or utilized may be

a subjective concept, and the figures of potential area that can be (and when) irrigated vary from one project to another. Subject to these limitations, some data on capital costs of irrigation projects are presented below.

Capital Costs of Surface Irrigation Projects

Here, a distinction is to be made between major and medium projects, and minor projects. According to a recent estimate (Vohra 1986) the cost of creating one ha of irrigation potential (in India) through the major and medium irrigation route stood at Rs 1,200 in the First Plan (1951-56); it rose to as much as Rs 19,271 during the Sixth Plan (1980-85). It is now projected to be as high as Rs 26,872 in the Current (Seventh) Plan. Although these figures are not comparable due to price changes over time, recent figures do indicate the order of magnitude involved. Thus, on average, at 1984-85 prices, the capital cost of an additional hectare of area to be irrigated (potential created) would be around Rs 27,000 (US$2,250).

Major and Medium Projects in Bihar

According to the latest estimates, a total expenditure of Rs 7,135 million was spent on creating an additional potential of 427,000 ha. This gives an average figure of Rs 16,710/ha of potential created. However, it has been found that out of the cumulative irrigation potential created of 2.88 million ha by the end of the Sixth Plan, the cumulative utilization was only 2.18 million ha, i.e., 76 percent. If this is taken into account, the capital costs of major and medium irrigation projects would be Rs 22,000 (US$1,832) per ha of potential actually utilized An estimated expenditure of Rs 6,023 million is expected to be spent on 3 major and 20 medium schemes during the Seventh Plan (1985-90).

Table 6.3 presents data on capital costs and potential created of a number of major projects over approximately the last twenty years. Some of these projects, e.g., Kosi and Gandak Canal Systems, have been under construction for 20-25 years, and hence, these figures cannot be used unless a breakdown of the capital cost of each year is available and these figures can be re-estimated at 1984-85 prices. The only figure which seems to be usable is that of Subarnarekha Project which has recently been taken up and the cost estimate is based on 1984-85 prices. This gives a capital cost of Rs 24,050 (US$2,000) per ha of potential created at 1984-85 prices.

Expenditures on Command Area Development Programs

It has been suggested by the Government of Bihar that the main reasons for the gap between potential created and potential utilized is nonavailability of 5-8 ha field channels, specially in the Kosi and Gandak command areas. Hence, the government has proposed some activities under the CADA programs which involve expenditures on direction and administration, surveys, demonstration and training, construction of field channels and field drains, on-farm development work, and land

levelling. During the Sixth Plan, investments of Rs 775/ha on construction of field channels and Rs 120/ha on infrastructural items were made (Table 6.5). Even with these investments and the establishment of Command Area Authorities, the construction of field channels is not matching the creation of additional potential every year.

Table 6.5. Expenditure on command area development programs in Bihar.

Expenditure	Capital expenditure		Revenue Expenditure	
	1984-85	1980-85	1984-85	1980- 85
Direction & administration			7.4	23.6
Survey etc.			24.0	112.0
Trial, demonstration, training			7.0	
Grant and loan for construction of field channels	94.0	310		
On farm development subsidy	22.0	430		
Physical achievements				
Soil surveys etc.(000 ha)			200	1118
Construction of field channels (000 ha)	255	943		
Capital expenditures per ha				
Construction of field channels	370	330		
Subsidy on on-farm development		445		
Subtotal		775		

Source: Government of Bihar, Irrigation Department, Formulation of Draft Seventh Plan for Command Area Development in Bihar (1985-90).

The main difficulty in construction of field channels is non-availability of land. At present, farmers are expected to donate land for these channels, and this is not forthcoming as per program. Whatever land has been obtained is along the periphery of the plots, resulting in longer channels involving higher costs and increased conveyance and seepage losses. In view of these difficulties, it is being suggested in government circles that the land acquisition cost of field channels should be borne by the government to accelerate the construction program. This would further raise the capital cost of providing irrigation through surface projects. To recapitulate, the total cost of utilizing potential created in Bihar, at 1984-85 prices, is around Rs 25,000/ha or approximately US$2,100/ha.

Capital Costs of Major and Minor Projects in Haryana

Table 6.4 gives data on capital costs of some recent projects undertaken in Haryana. The average cost of projects undertaken during 1973-78 was Rs 6,074/ha of potential created and Rs 29,730/ha of

potential utilized. The average cost of ongoing major schemes during the Sixth Plan (1980-85) was estimated at Rs 24,930/ha of potential created. The corresponding figure for medium schemes was Rs 5,272/ha. Estimated expenditure on new major schemes was Rs 14,810/ha of potential created. The capital costs for a number of major and medium lift irrigation schemes ranged between Rs 3,675 and Rs 6,084/ha. However, it is difficult to judge these figures because many of these are not new schemes (i.e., where irrigation is being provided for the first time), and it is difficult to estimate the potential actually utilized. Thus, a representative figure for Haryana will be an average of ongoing and new major schemes undertaken during the Sixth Plan, i.e., a capital cost of Rs 22,230 or US$1,850/ha of potential created.

Minor Irrigation Projects in Bihar

Table 6.6 gives data on capital expenditures incurred on minor irrigation development in Bihar during 1980-85. Out of the estimated 1.1 million ha of potential created, 0.8 million ha is through groundwater schemes. Since the cost of groundwater schemes is not given separately, it is assumed that this average figure of Rs 2,786/ha would be true for small-scale private tube wells. This cost excludes the capital cost of rural electrification which is incurred by the State Electricity Board and is not being accounted for by the Minor Irrigation Department. According to a recent study (Bhatia 1986), the capital costs of generation and transmission for energization of an electric pump-set are Rs 20,000/kilowatt (kw) or Rs 40,000 per pump-set of 2 kw. Since the demand for pumping will coincide with other loads, it would not be possible to use this generation and transmission capacity created for meeting the demand of pump-sets.

Table 6.6. Capital expenditures incurred on minor irrigation works in Bihar during the Sixth Plan (excluding costs of electrification).

		Groundwater	Surface water	Total
1.	Ultimate potential (million ha)	4.0	1.9	5.9
2.	Potential created before 1980-85 (million ha)	2.1	1.2	3.3
3.	Potential created during 1980-85 (million ha)	0.8	0.3	1.1
4.	Expenditure incurred (1980-85) by Minor Irrigation Department (Rs million)			2315
5.	Liability in the form of a bank loan, electricity bill, subsidy and payments to contractors etc.			750
6.	Total expenditures (4+5)			3065
7.	Total expenditures per ha of potential created			2786
8.	Capital costs per ha of potential created (excluding electricity bill etc.)			2105

Source: Government of Bihar. Seventh Five Year Plan, Minor Irrigation Department.

However, to allow for some utilization for other purposes, only 50 percent of the total cost is attributed to water pumping, i.e., the capital cost included is Rs 20,000 per pump-set. To this one should add the cost of subtransmission (i.e., 11-kilovolt, low-tension line) and connection which would be around Rs 10,000 per pump-set, particularly in Bihar where a large number of villages have not yet been electrified. This gives a total capital cost of electrification of a pump-set at Rs 30,000. The area irrigated by a 2-kw pump-set depends on a number of factors such as farm size, fragmentation of holdings, and cropping pattern. If only supplementary irrigation is provided for rice, a 2-kw pump-set can easily irrigate 2 ha of wheat. Given the fact that 76 percent of the total number of holdings are below 1 ha and the number of fragments per holding are between 17 and 20, it is very unlikely that, on average, an electric pump-set will effectively irrigate more than 1 ha. Thus, the capital cost to society of providing irrigation to 1 ha would be Rs 52,800 or US$4,400 when total capital costs incurred are taken into account. Obviously, the capital cost to the farmer would be very low, since he is not required to pay for the costs of connection and low-tension distribution lines or for the high capital costs of generation and transmission through tariffs which reflect long-run marginal costs of supplying electricity to the rural areas.[7]

State tube wells. Since the existing state tube wells were constructed before 1980-81, data on capital cost of these will not be of much use. In a new project for construction of 500 state tube wells in Bihar (which was evaluated in 1986), the capital cost of one tube well is Rs 75,230. The potential area to be irrigated is 50 ha per tube well, i.e., a capital cost of Rs 1,500/ha of potential created. During the last 5 years, an average tube well irrigated around 20 ha, giving a figure of Rs 3,760/ha of actual irrigated area. However, these costs do not include capital costs of generation, transmission, and distribution. For a 1.5-2 cusec tube well, the pump-set would have to be about 10 horse power (hp) or 7.46 kw under conditions in Bihar, where the water table is quite high. This would give a capital cost of generation and transmission of Rs 150,000. This capital cost could be shared with other consumers of electricity if water pumping is done during hours which do not coincide with the system peak. Since demand for water pumping is seasonal and farmers require water during a given period, very much staggering of the pumping load may not be possible. Assuming that about half the capital cost is attributed to other uses, this would give a capital cost of Rs 85,000 (including Rs 10,000 for cost of connection) per tube well or Rs 4,250/ha. Thus, the estimated capital cost of providing irrigation through state tube wells is Rs 8,260/ha when considered from the viewpoint of society (i.e., when total costs are included).

A Comparison of Costs

A comparison of capital costs of an irrigated ha is presented in Table 6.7. It may be noted that from the viewpoint of society, use of groundwater through state tube wells has the lowest capital cost per ha, followed by surface irrigation through major and medium projects.[8] However, as will be discussed

[7]Electricity tariffs for agriculture are very low and do not cover even 15-20 percent of the real cost of providing electricity. Besides, there is large-scale theft of electricity (through unauthorized tapping of wires), particularly in Bihar. These are the main reasons for the huge losses incurred by the State Electricity Board. The losses for Bihar and Haryana in 1982-83 were Rs. 927 million and Rs. 29 million, respectively. Accumulated arrears of interest up to 1982-83 were Rs. 2,016 million and Rs. 150 million, respectively, See Finance Commission (1984).

[8]Data on surface irrigation through minor projects were considered not reliable enough (both capital and potential created) to be used for comparison.

in the next section, O&M expenses (including electricity charges) for state tube wells range between Rs 1,724 and Rs 4,257 per ha for potential created and gross irrigated area, respectively.

Table 6.7. A comparison of capital costs of surface and groundwater projects undertaken during 1980-85.

	Rs per ha of potential created	Rs per ha of potential utilized
Surface irrigation major & medium projects		
Bihar	16710	22000
(including command area development)	17610	22900
Haryana	22230	n.a.
Groundwater projects (excluding electrification)		
Bihar		
State Tube Well Corporation	1500	3760
Minor irrigation (of which 80 percent is groundwater)	2786	2786
Groundwater projects (including electrification; i.e., cost to society)		
State tube wells	5750	8010
Private tube wells	32786	32786

Source: Tables 6.3, 6.4, 6.5, 6.6.

OPERATION AND MAINTENANCE COSTS

Allocations by State governments for O&M of irrigation projects has been the concern of a number of government committees or commissions[9]. According to the Public Accounts Committee (1983), which examined the planning process and monitoring mechanism in relation to irrigation projects, "maintenance of existing irrigation systems is not getting the attention of the States as required. The main reason for this is seen to be inadequate allocation made available by the States."

The Irrigation Department (Central Government) in a note sent to the Seventh Finance Commission in November 1977 suggested that the department considered that neglecting maintenance of irrigation and drainage systems was the main reason for underutilization of irrigation potential. The department reported that a Central Water Utilization Team had found O&M budgets to be grossly

[9]As estimated by the Irrigation Commission (1972), public irrigation works in Bihar and Haryana were making losses in 1967-68.

inadequate in many cases and the systems to be gradually deteriorating. The Finance Commission (1983) examined the data submitted by the Union Ministry of Irrigation and found that maintenance expenditures incurred varied widely, not only from State to State, but also from project to project within the same State. For instance, the maintenance expenditure in Maharashtra in the year 1979-80 was only Rs 27.95/ha on the Gangapur project, whereas for Jayakwadi project it was as high as Rs 171.7/ha for the same year. In Punjab, the variation was from a minimum of Rs 9.10/ha on the Upper Doab Canal System to Rs 38.66/ha on the Bhakra Canal System. Some States suggested to the Eighth Finance Commission certain norms of expenditure for maintenance of multipurpose, major and medium irrigation works for the period 1984-85 to 1988-89. Bihar suggested a norm of Rs 120/ha of gross irrigated area for the plains, while Haryana suggested Rs 75/ha of irrigated area. The figures suggested by other States were: Rs 127/ha of irrigated area in Uttar Pradesh; Rs 100 each per hectare of irrigation potential in Gujarat and net irrigated area in Tamil Nadu.

O&M Expenses in Bihar

Data on O&M expenses have been obtained a) from the Annual Budget papers of the Government of Bihar for the year 1984-85 and b) from the Irrigation Department, Government of Bihar for the period 1980-81 to 1984-85 for major irrigation projects. Table 6.8 presents data on O&M expenses

Table 6.8. Expenses and receipts from irrigation projects in Bihar: 1984-85.

	Total (Rs million)	Per ha of irrigated area[a]	
		Rs	US$[b]
Expenses			
Operation and maintenance	167.6	81.4	6.8
Revenue establishment	70.7	34.3	2.8
Total (including 4.5 million for direction & administration)	242.8	117.9	9.6
Receipts			
Sale of water for irrigation	126.4	61.4	5.1
Other receipts	n.a.	n.a.	n.a.
Total receipts	126.4	61.4	5.1
Net revenue after deducting cost of collection	55.7	27.1	2.3
Net revenue as percent of O&M costs	33.2	33.2	
Net receipts after deducting cost of collection and O&M costs	-116.4	-56.5	-4.5

[a]Assuming irrigation potential utilized in 1984-85 as 2.06 million ha.

[b]Assuming US$1 = Rs 12.

Source: Government of Bihar, Budget 1985-86:77-80, 186-192.

for 1984-85, indicating that Rs 167.6 million was allocated for multipurpose projects and irrigation projects. Taking the figure of irrigation potential utilized in 1984-85 at 2.06 million ha, this gives an estimated O&M allocation of Rs 81.4 (US$6.8) per ha. The budget also provides information on expenditure on revenue establishment which was estimated at Rs 70.7 million or Rs 34.3/ha.

Similar data for a period of five years are available for four major projects (Sone, Kosi, Badua and Chandan), and are presented in Table 6.9. The costs of establishment (salaries and wages) have risen significantly over the last five years, particularly during the last two years. The increase in 1984-85 over 1980-81 was 260 percent for expenses on irrigation establishment.

Table 6.9. Costs of establishment, works and costs of revenue collection from Major Irrigation Projects[a] in Bihar (Rs. million).

	1980-81	81-82	82-83	83-84	84-85
A. Total costs					
— Establishment	9.1	15.2	20.4	30.0	32.7
— Works	50.2	50.8	53.6	46.3	48.4
— Subtotal	59.3	66.0	74.0	76.3	81.1
— Revenue establishment	29.8	37.1	52.0	60.7	63.6
— Total	89.1	103.1	126.0	137.0	144.7
B. Irrigated area: potential utilized (cumulative) (million ha)	1.18	1.26	1.34	1.42	1.52
C. Costs per ha (Rs)					
— Establishment	7.7	12.1	15.2	21.1	21.5
— Works	42.5	40.3	40.0	32.6	31.8
— Subtotal	50.2	52.4	55.2	53.7	53.3
— Revenue establishment	14.7	29.4	38.8	42.7	41.8
— Total	64.9	81.8	94.0	96.4	95.1

[a]The irrigation projects included are: Sone, Kosi, Badua and Chandan.
Source: Department of Irrigation, Government of Bihar.

It is reported that recently there has been a change in the practice of allotting major repair and maintenance work to contractors. Jobs which were earlier given to contractors are now being undertaken by the Irrigation Department itself. This may partly explain the 'jump' of almost 50 percent in establishment costs in 1983-84. This seems to be the case if one looks at the estimated expenses under 'Works' which have declined during that year. The subtotal of expenses on establishment and works relating to O&M have increased from Rs 59.3 million in 1980-81 to Rs

81.1 million in 1984-85; an increase of 37 percent in current prices. These increases in costs would be much lower if adjustments are made for changes in prices (wages) of field labor and materials.[10]

The adjustment by Wholesale Price Index for all commodities gives the following results: a) The establishment component of O&M costs has increased by 173 percent in real terms over the 5-year period; b) the works component has declined by 23 percent in real terms; and c) the subtotal of O&M expenses has increased by 4 percent in real terms; d) the revenue establishment expenses have increased by 62 percent in real terms (instead of by 113 percent in nominal terms); and e) the sum of O&M costs and revenue establishment expenses has risen by 23 percent in 1984-85 over 1980-81, at constant prices.

If these figures of O&M expenses are divided by irrigated area (cumulative potential utilized for these projects), O&M expenses are (Rs/ha) 50.2 for 1980-81 and 53.3 in 1984-85, showing a remarkable stability.[11] However, expenses on revenue establishment have increased significantly: 184 percent over the 5-year period. The costs of revenue establishment which were Rs 14.7/ha in 1980-81 have increased to Rs 41.8/ha in 1984-85. This gives a total expense of Rs 95.1/ha on O&M costs and revenue establishment in 1984-85, showing an increase of 47 percent over the 5-year period. Note that expenses on revenue establishment, which were about one-half of the total O&M expenses in 1980-81, have increased to about 78 percent of the latter in 1984-85. As between expenses on establishment and works, the share of works has declined from about 85 percent in 1980-81 to about 60 percent of the total in 1984-85. This decline may be reflecting either a change in policy (where more work is being done departmentally) or a genuine reduction in expenses on repairs on account of increasing expenses on maintaining the establishment. Since salaries and wages for regular employees of the department would be the first charge on funds allocated to O&M, it is quite likely that a threefold increase in establishment is at the cost of repair and maintenance work on the canals, distributaries and minors.

Similar trends may be noted in the O&M costs and the expenses on revenue establishment in the case of Sone Canal, the oldest system in the State (Table 6.10). While establishment costs and expenses on revenue collection have each almost doubled over the 5-year period, the expenses on works have increased only marginally (5%). The figures for the Kosi project also show the same pattern: a stagnation (actually a decline from Rs 33.6 million to Rs 30.1 million) in the expenses shown under 'Works' and an increase of more than 700 percent in O&M establishment costs (Table 6.11). Establishment costs of revenue collection have also increased by 125 percent from Rs 10.7 million to Rs 24.1 million over the 5-year period. Thus, these phenomenal increases in establishment expenses need to be analyzed in-depth and it would be necessary to evaluate the reductions in 'Works' costs and their implications for the quality of O&M functions performed by (or on behalf of) the Irrigation

[10]The index of O&M charges increased by 62 percent in 7 years, 1975-76 to 1981-82. It was found that the index of the wholesale prices (WPI) for all commodities also increased by about 62 percent over the same period, although year to year variations are somewhat different. Hence, the WPI for all commodities has been used to deflate O&M expenses as well as receipts for the period 1980-81 to 1984-85. The WPI shows an increase of 31.5 percent over the 5-year period.

[11]It may be pointed out that these figures of potential utilized seem to be overestimates as these have been obtained by i) approximating the canal irrigated areas in Northeast alluvial plains with those of Kosi, and those in Southwest alluvial plains with those of Sone and ii) adding the 'entire' increase in potential utilized in the State during this period to these four projects.

Department. The increase in establishment costs of O&M as well as revenue collection is very high, even when adjustments for price changes are made. In fact, the reductions in expenditure on 'Works' in real terms would be even higher, i.e., 20 percent for Sone and 32 percent for Kosi projects, respectively.

Table 6.10. Costs of establishment, works and revenue collection[a] for Sone Canal Project (in Rs million).

	1980-81	81-82	82-83	83-84	84-85	Percentage increase (1984-85 over 1980-81)
1. Establishment costs	5.9	5.9	8.0	8.5	11.1	88
2. Works	12.8	14.3	14.0	15.3	13.4	5
3. Subtotal (1+2)	18.7	20.2	22.0	23.8	24.5	31
4. Cost of revenue collection	19.1	23.0	28.3	39.3	39.5	106
5. Total (3+4)	37.8	43.2	50.3	63.1	63.0	66

[a]These figures are marginally different from those obtained from the Budget papers.
Source: Irrigation Department, Government of Bihar.

Table 6.11. Costs of establishment, works and revenue collection[a] for Kosi Project (in Rs million).

	1980-81	81-82	82-83	83-84	84-85	Percentage increase (1984-85 over 1980-81)
1. Establishment costs	2.5	8.6	11.4	20.5	20.8	732
2. Works	33.6	32.0	34.1	26.5	30.1	-11
3. Subtotal (1+2)	36.1	40.6	45.5	47.0	50.9	41
4. Cost of revenue collection	10.7	14.2	23.7	21.4	24.1	125
5. Total (3+4)	46.8	54.8	69.2	68.4	75.0	60

[a]These figures are marginally different from those obtained from the Budget papers.
Source: Irrigation Department, Government of Bihar.

Financial performance of State tube wells in Bihar. The Bihar Water Development Corporation has been responsible for the construction and operation and maintenance of public tube wells with a discharge capacity varying from 1.5-2 cusecs. The Corporation is responsible for the installation of electric pumps,

the construction of channels, the maintenance of completed works, the supply of irrigation to fields, and the assessment and realization of water rates. Till 1985, the Government of Bihar had contributed Rs 100 million towards its share capital. The Corporation has a plan of creating an additional potential of 90,000 ha during the Seventh Plan (1985-90). A provision of Rs 450 million has been made for 1985-90 which includes Rs 140 million towards increased share capital of the Government of Bihar.

The performance of public tube wells has not been satisfactory in Bihar. As shown in Table 6.12, out of 5,311 state tube wells constructed up to 1984-85, about 400-500 have not been energized for the last 3 years. The average number of working tube wells has declined from 3,469 in 1980-81 to 2,167 in 1984-85. This shows that in 1984-85, only 44 percent of energized tube wells (and 40 percent of total constructed) were in working condition. The main reasons for nonfunctioning are given as noneffective management, lack of power, and lack of maintenance of pump-sets and channels. As a result, the total area irrigated by state tube wells has declined from 77,000 ha in 1980-81 to 35,000 ha in 1984-85. In 1984-85, area irrigated per working state tube wells was 16.2 ha as against the estimated command area of 40 ha.

Table 6.12. Financial performance of public tube wells in Bihar.

	Unit	1980-81	81-82	82-83	83-84	84-85
	1	2	3	4	5	6
1. Number of tube wells constructed (cumulative)	Number	5281	5311	5311	5311	5311
2. Tube wells in working condition (cumulative)	Number	3469	3364	3452	2812	2167
3. Total area irrigated	'000 ha	77	83	100	50	35
4. Area irrigated per TW[a]	ha	22.2	24.7	29.0	17.8	16.2
5. Total revenue collection	Rs million	Nil	0.77	0.61	0.55	0.56
6. Revenue collection per TW	Rs	Nil	230	177	196	254
7. Revenue collection per ha	Rs	Nil	9.3	6.1	11.0	15.7
8. Establishment expenses of Bihar Water Development Corporation (total)	Rs million	62	60	82	77	90
9. Estimated electricity expenses (total)	Rs million	46	46	48	49	59
10. Total expenses (8+9)	Rs million	108	106	130	126	149
11. Electricity expenses per TW	Rs	13260	13674	13900	17425	27226
12. Total expenses per TW	Rs	31133	31510	37660	44800	68760
13. Total expenses per ha	Rs	1402	1276	1300	2517	4244
14. Net losses (7-10)	Rs million	108	105	129	125	148
15. Revenue collection as percent of total expenses	%	0	0.7	0.5	0.4	0.4

[a]Tube well

Source: Bihar Water Development Corporation, Patna.

An analysis of O&M costs shows that during 1984-85, Rs 90 million was spent on the establishment expenses of the Corporation while Rs 59 million was the estimated electricity expenditure.[12]

O&M Expenses in Haryana

The working expenses (direct and indirect) for irrigation projects in Haryana are presented in Table 6.13. During the period 1975-76 to 1981-82, these expenses have increased (at current prices) from Rs 115 million to Rs 207 million, i.e., an increase of 80 percent over the 7-year period. However, the estimated index of O&M charges, accounting for changes in prices of field labor and materials (cement, steel structure, paints, etc.), increased from 100 in 1975-76 to 162 in 1981-82. When total working expenses are deflated by this index used by the Eighth Finance Commission in its report (1984), the increase in working expenses in real terms has been quite low (only 11%). This shows that the near doubling of total working expenses in Haryana is mainly due to changes in prices of labor and materials.

Table 6.13. Gross receipts and working expenses of irrigation projects in Haryana: In real terms, 1977-78 to 1981-82 (Rs million).

Year	Gross Receipts (Current Prices)	Working Expenses (Current Prices)	Index of Wholesale Prices (1975-76 = 100)	Gross Receipts deflated by Wholesale Price Index (1975-76 = 100)	Estimated Index[a] of O&M Charges (1975-76 = 100)	Working Expenses deflated by Index of O&M Charges	Percent of Receipts to Working Expenses
1	2	3	4	5	6	7	8=5/7
1975-76	85	115	100	85	100	115	74
1976-77	111	101	102	109	107	94	116
1977-78	89	116	107	83	111	105	79
1978-79	95	001	107	89	118	111	80
1979-80	80	164	126	63	001	125	50
1980-81	101	181	148	68	142	127	54
1981-82	108	207	163	66	162	128	52
Percent increase 1981-82 over 75-76	27%	80%	63%	-	62%	11%	-

[a]This is a consolidated index as estimated by the Eighth Finance Commission. It assumes that 80% of the maintenance costs are accounted for by field labor and 20% by materials such as cement, steel structures, paints and varnishes etc.

[12]It may be noted that due to shortage of funds, the BWDC does not pay the State Electricity Board the charges which are due for operation of the TWs. These charges were estimated at Rs 27,226 per TW out of a total estimated O&M expenses of Rs 68,760 per TW. The deficit for BWDC would partly explain the commercial losses of Rs 927 million of the Bihar State Electricity Board for the year 1982-83.

During the same period, gross irrigated area from government canals increased from 1.69 to 1.86 million ha, an increase of 10 percent. The estimated working expenses at current prices increased from Rs 68/ha in 1975-76 to Rs 113/ha in 1982-83, an increase of 66 percent. (These were 3 times those of 1973-74). However, when the increase in prices of field labor and materials is taken into account, the working expenses in real terms have not increased at all during the period 1975-76 to 1982-83.

Comparison of O&M Expenses

Table 6.14 presents a comparison of O&M expenses in government-managed irrigation systems for 1984-85. In Bihar, O&M expenses range between Rs 44.7/ha in Sone Canal and Rs 120/ha for the Kosi project. In contrast, in Haryana, on average, O&M expenses (after deducting 10% for revenue establishment) are Rs 120/ha. However, since cost of revenue establishment is relatively higher in Bihar, the sum of O&M expenses and revenue establishment is Rs 117/ha for Sone and Rs 177/ha for Kosi. The O&M expenses for state tube wells are very high at Rs 4,257/ha of irrigated area (potential utilized).

Table 6.14. A comparison of O&M expenses and receipts in government-managed irrigation systems (1984-85).

	Rs per hectare of potential utilized				
	O&M expenses	Cost of Revenue establishment	Gross Receipts	Net Receipts	Net Receipts as percent of O&M Expenses
Bihar					
Surface Irrigation					
Major irrigation projects	81.4	34.3	61.4	27.1	33
Four major projects	53.3	41	n.a.	n.a.	n.a.
Sone canal	44.7	72	110	38	85
Kosi project	120	57	45	-12	Negative
Groundwater					
State tube wells	4257	a	16	16	0.4
Haryana					
(working expenses, direct, and indirect)	133	a	51	51	38

[a]Included in O&M Expenses.

Notes: 1. Sources: See Tables 6.9, 6.10, 6.11, and 6.13.
2. Figure for Haryana for 1982-83 has been converted to 1984-85 prices by using Wholesale Price Index for all-commodities which corresponds to prices of field labor and materials.
3. For Sone, irrigated area is taken as 0.548; for Kosi as 0.425 per ha at 76 percent utilization of ultimate potential

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Details of O&M Expenses and Costs of Revenue Establishment

Table 6.15 gives details of expenditure on irrigation projects (excluding multipurpose projects) in Bihar for 1984-85. According to this, establishment costs, i.e., salaries of workers and officers, account for two-thirds of the total current expenses. Revenue establishment accounts for about 60 percent of these establishment costs which are predominantly (90 percent) salaries and wages. Motor vehicles account for about 2 percent of the total while machinery, tools, and plant account for less than one percent of the total expenses. The Irrigation Department spent about one-third of the total allocation, i.e., Rs 32.1 million, on repair and maintenance. Senior officials (superintending engineer and executive engineers) said that at the field levels, approximately 10 percent of this cost is incurred on fixed expenditure on labor and vehicles, 40 percent on earthwork in canals, 25 percent on repair of structures, 15 percent on repair and maintenance of buildings, and around 10 percent on new buildings and quarters. Of the total allocation for repair and maintenance, about 50 percent is spent on materials (cement, steel, bricks, sand) and the rest on labor. Thus, almost 80 percent of the total O&M expenses are essentially payments of salaries to officers, wages to laborers, and office expenses. (See Tables 6.16 and 6.17 for further details for major irrigation projects as well as for the Kosi project.) The estimated number of senior staff on O&M work in the State of Bihar are: 15 chief engineers, 100 superintending engineers, 200 executive engineers, 600 assistant engineers, and 1,800 junior engineers. Because of the prevailing unemployment situation, there are strong political pressures to recruit more staff at the officer as well as the worker levels.

Table 6.15. Details of expenditure on irrigation projects (excluding) multi-purpose projects in Bihar: 1984-85 (in Rs million).

		Total	Percent of Total
1.	*Establishment* (including revenue establishment)[a]		
	- salaries and allowances of officers	5.1	5
	- salaries and allowances of workers	53.9	54
	- office expenses	6.3	6
	- total establishment	65.3	65
2.	Repairs & maintenance	32.1	32
3.	Machinery, tools & plant	0.3	1
4.	Motor vehicles	1.7	2
5.	Total	99.4	100

[a]Details of revenue establishment are as follows: salaries of officers Rs 0.5 million; salaries of workers Rs 34.2 million and office expenses etc., Rs 4.8 million.

Source: Government of Bihar, Irrigation Department: Details of Budget 1985-86, Patna 1985. 0. -- less than 0.5 percent. Also see Table 6.16.

Table 6.16. Details of expenditures on irrigation projects[a] (excluding multipurpose projects): 1984-85 (in Rs thousands).

	Salaries of officers (including D.A.)	Salaries of workers (including D.A.)	Office expenses	Travel expenses	Payments for commercial services	Machinery (tools & plant)	Others	Sub total of estab. expenses	Motor vehicles	Maintenance and repairs	Total	Percent of column total
	1	2	3	4	5	6	7	8	9	10	11	12
Direction and administration	665	2797	306	264			271	403	143	-	4446	4
Revenue establishment	518	34229	483	1030	1953	294	965	39472	-	-	39472	40
Sone and other South Bihar irrigation projects	1583	9125	130	195	28	111	-	11172	764	11594	23530	24
Kamla and other North Bihar irrigation projects	774	2488	35	114	-	150	-	3561	40	2177	5778	6
Chhota-nagpur and Santhal Pargana irrigation projects	150	815	15	20				1000	347	5393	6740	7
South Bihar irrigation projects	1419	4457					220	6096	450	12958	19504	19
Total	5109	53911	969	1623	1981	555	1456	65604	1744	32122	99470	
Percent of row total	(5)	(54)	(1)	(2)	(2)		(2)	(66)	(2)	(32)	(100)	

Source: Government of Bihar, Irrigation Department: Details of Budget 1985-86, Patna 1985, pp.– less than 0.5 percent.

Table 6.17. Details of Expenses on Establishment: Kosi Project, 1985-86 (Budget Estimates) - (in Rs thousands).

	Salaries of officers	Salaries of workers	Maintenance allowance of officers	Maintenance allowance of workers	Travel expenses	Office expenses	Total	Percent of column total
Kosi Barrage and main works	295	14505	90	2653	206	51	17800	53
Repair and maintenance (western bank)	150	1385	50	350	40	25	2000	6
Repair and maintenance (eastern bank)	325	1650	99	370	61	45	2550	7
Repair and maintenance of main canals and branches	740	7690	210	2120	215	295	11270	34
Sub-total	1510	25230	449	5493	522	416	33620	
Percent of row total	5	75	1	16	2	1		100

Source: Government of Bihar, Irrigation Department: Detailed Budget for 1985-86, Patna, 1985.

Since revenue establishment accounts for a major share of total current expenditures in Bihar, further disaggregated information on these expenditures has been provided in Table 6.18. Salaries of workers account for about 70 percent of the total expenditures, while their living allowances take up another 15-20 percent. Travel expenses and payments for commercial services account for 2 and 3 percent, respectively. The share of salaries and living allowances of officers is rather low at less than 2 percent of the total expenditures. There are a large number of people working for revenue collection at the *tehsil* (an administrative and revenue unit consisting of a number of villages) level as well as at the *circle* level. There are officers (*zilladars*) and revenue clerks for assessment and collection work. The number of posts sanctioned is determined by the number of water charge receipts to be prepared.

Table 6.18. Details of expenditures on revenue establishment for Bihar irrigation projects: 1985-86, (in Rs thousands).

	Irrigation projects		Multipurpose river valley projects	
	Total	Percent	Total	Percent
1. Salaries of officers	610	2	228	-
2. Living allowances of officers	167	-	56	-
3. Salaries of workers	29794	70	24008	67
4. Living allowances of workers	8126	19	6347	18
5. Travel expenses	965	2	603	2
6. Office expenses	396	1	435	1
7. Payments for commercial & special services	1838	5	1055	3
8. Rents & taxes	540	1	n.a.	n.a.
9. Machinery, tools and plant	284	-	n.a.	n.a.
10. Others			3372	9
11. Total	42720	100	36104	100

- Below 0.5 per cent.
Source: Government of Bihar, Irrigation Department, Detailed Accounts of Receipts and Expenditures for 1985-86; 1985.

Because Bihar has a large number of small farms (about 76% of the total are less than 1 ha), it takes a large number of people to prepare the receipts and then approach farmers for collection of money. Because of high population density and large-scale unemployment, there are strong political pressures to provide employment in the Irrigation Department. As a result, the number of people

actually working exceeds the number of sanctioned posts. The State Government has recently appointed a Committee to review the functioning of revenue administration in the Irrigation Department. This Committee is considering a number of suggestions which will rationalize the structure of revenue administration and improve its efficiency.

In the case of Haryana, revenue establishment costs account for 17 percent of the total for multipurpose projects and 10 percent of the total for irrigation projects. Salaries of officers (excluding revenue staff) accounted for about 33-39 percent of the total (Table 6.19). Repair and maintenance accounted for about two-thirds of the total expenses on O&M. However, these maintenance expenses include the wages of workers and technical personnel at the lower level. Hence, these expenses do not really reflect the quality of maintenance work carried out in the canal system.

Table 6.19. Details of O&M expenditures on irrigation projects in Haryana: 1984-85.

	Multipurpose river projects (Bhakra-Nangal)			Irrigation projects		
	Rs million	% of total (excluding revenue estab.)	% of total (including revenue estab.)	Rs million	% of total (excluding revenue estab.)	% of total (including revenue estab.)
1. Salaries of officers[a]						
- Chief Engineer, Supd. Engineers	1.6	3	2	7.3	7	6
- Executive Engineers	21.9	36	30	29.7	26	24
- Total	23.5	39	32	37.0	33	30
2. Extension & improvement, maintenance	37.0	61	51	75.2	67	60
3. Subtotal	60.5	100	83	112.2	100	
4. Revenue establishment	11.7		17	12.3		10
5. Total	72.2		100	124.5		100

[a]Includes salaries of Chief Engineer, Superintending Engineers and Executive Engineers. Salaries of workers are included under Repair & Maintenance.

Source: Government of Haryana. Budget 1985-86, vol.II.

Adequacy of O&M Expenses

As mentioned earlier, the Public Accounts Committee (1983) and the Irrigation Department (Central Government) think that "maintenance of existing irrigation systems is not getting the attention of the states as required" and "one of the main reasons for under-utilization of irrigation potential was that the maintenance of irrigation and drainage systems was neglected." From the

analysis of O&M expenses in the last section, one can conclude that expenditures on repair and maintenance of structures and canals have declined while expenses on staff salaries and wages have increased over time. In fact, the pressures at the field level are such that only a minimum of repairs is carried out with the money that is left after payments of wages have been made.

Given the fact that relatively old structures need more maintenance and repair, the impact of neglect of basic repairs is difficult to estimate in the case of old systems such as the Sone canal. It is essential to conduct detailed studies on O&M expenses, on the type of repairs and maintenance done, and on the impact of lack of repairs on productivity of irrigation projects. Such investigations alone can provide information for corrective action.

However, since such data on the impact of existing levels of O&M expenses are difficult to obtain, it may be useful to review the "estimates" of norms of expenditure on irrigation projects. The Irrigation Commission (1972) used Rs 15/ha as the figure for O&M expense in 1970-71.

The Finance Commission (1973) agreed with the Union Ministry of Irrigation that Rs 25-30/ha might be taken to represent a reasonable limit for maintenance of irrigation works. Accordingly, in the early seventies, the Finance Commission worked out the financial requirements of States for maintenance of irrigation works at the rate of Rs 25/ha irrigated by government sources of irrigation, whether by canals, tanks, or government wells including tube wells. If adjustment for changes in prices of labor and materials is made, the norm adopted by the then Finance Commission would indicate a level of approximately Rs 50/ha (in 1981-82) for maintenance of irrigation works.

The Eighth Finance Commission report provides a discussion of the norms of expenditure proposed by the Seventh Conference of Irrigation Ministers of States held in December 1982. Based on the recommendations of this conference, the Union Ministry of Irrigation proposed the following norms for maintenance:

a) Operation and maintenance expenses of irrigation systems may be placed at Rs 100 per hectare of culturable command area, where irrigation intensities are less than 100 percent, and Rs 100 per hectare of potential/irrigated area, where irrigation intensities are more than 100 percent. This provision should be exclusive of regular establishment charges.

b) For special repairs, provision should be made at the rate of 20 percent of the annual grants for normal operation and maintenance.

c) Regular establishment required for maintenance of canals should be financed separately. Based on typical studies carried out by the Central Water Commission a provision of Rs 50 per hectare of irrigated area may be made till more data become available from the States.

d) The States should also review and revise their water charges upwards with regular periodicity to ensure that the costs of operation and maintenance are met fully, and a return on capital investment of at least one percent is realized.

The Eighth Finance Commission (1984) thought that the norms suggested by the Ministry of Irrigation (which worked out to Rs 170/ha of irrigated area in the plains) were quite high. According to the Commission, the norm of Rs 50/ha fixed by the Seventh Finance Commission would work out to about Rs 88 in 1983-84 after taking into account the trend in increase in prices of labor and materials used in O&M. The Commission observed that the Note of the Ministry of Irrigation sent to the Seventh Finance Commission on 2 November 1977, alluded to the emphasis laid by the World Bank on operation and maintenance strictly in accordance with sound engineering principles. Hence, the Rs 50/ha recommended by the Seventh Finance Commission was considered to reflect the needs of funds for proper maintenance. Thus, the Eighth Finance Commission considered that Rs 88/ha in 1983-84 was adequate for maintenance. The Commission further noted that "the sum of Rs 50/ha of irrigated area seems to be rather excessive when we consider the fact that in the case of roads and buildings, provision for regular establishment is being made at 16 percent of the provision for normal repairs." Keeping all these aspects in view, the Eighth Finance Commission decided to provide a consolidated amount of Rs 100 per hectare of gross irrigated area for maintenance, including normal repairs, special repairs, and regular establishment. In addition, the Commission recommended the provision of funds at Rs 30/ha for maintenance of the unutilized potential existing at the end of 1983-84. This figure is much lower than the norms recommended by the Union Ministry of Irrigation. Even with these estimates of working expenses, the Commission estimated that the States would incur a loss of Rs 400 million during the five years 1984-85 to 1988-89.

Compared with the above norms of Rs 100/ha inclusive of regular establishment charges, the average O&M expenses incurred on four major irrigation projects in Bihar during 1980-81 to 1984-85 were Rs 50/ha, about two-thirds of which were for establishment. If revenue establishment is also included, these costs would be Rs 95/ha. In Haryana, working expenses were around Rs 110/ha in the early eighties. Assuming that these are inclusive of revenue administration, these estimates are quite near the norms suggested by the Eighth Finance Commission. However, in the case of Bihar, the average expenditure on O&M during the early eighties was much lower (Rs 22-38/ha) compared with the norm of Rs 88/ha, excluding costs of regular establishment.

FARMERS' ABILITY TO PAY FOR IRRIGATION SERVICES

Role of Price Policies for Output

The objectives of agricultural price policies as included under the terms of reference of the Agricultural Prices Commission, 1955, are: a) to provide incentives to the producer for adopting improved technology and for maximizing production and b) to ensure rational utilization of land and other production resources. In designing policies, the likely effect of the price policy on the rest of the economy, particularly on the cost of living, level of wages, and industrial cost structure must be considered. According to the revised terms of reference (1978), the Agricultural Prices Commission is required to take into account the changes in the terms of trade between the agricultural and the nonagricultural sector.[13] The Commission considers the cost of production, demand, and supply of

[13]For a detailed discussion of issues relating to agricultural prices and terms of trade, see Tyagi (1982), Kahlon and Tyagi (1983), Mishra (1985), Rath (1985).

agricultural commodities and discusses various aspects of policy with the ministries concerned, Planning Commission, and State Governments before it is put up for the approval of the Union Cabinet. Thus, the final decision is taken at the Cabinet level (Tyagi 1982).

Although, in theory, all efforts are made to ensure that farmers get remunerative prices, in practice, the price that the farmer gets for his produce depends upon the organizational and operational efficiency of the market structure. According to Kahlon and Tyagi (1983), "it is, therefore, not enough to have a price support/procurement policy for agricultural commodities. In fact, it is more important to develop a market structure which enables the farmer to realize at least the minimum support price." The analysis of data on procurement prices and open market prices during the harvest season shows that in the States where infrastructure facilities are good (e.g., Punjab, Haryana, Western Uttar Pradesh), market prices for wheat were higher than procurement prices fixed by the government, but in Rajasthan wheat was quoted at prices which were about 20 percent lower than the procurement prices. Similarly, in the case of rice, whereas in Andhra Pradesh, Punjab, and Haryana, the open market prices remained either equal to or higher than the procurement prices during the late seventies, in Madhya Pradesh and Orissa the prices of unmilled rice were occasionally lower than the procurement price (Kahlon and Tyagi 1983:415). The phenomenon of farmers getting prices which were 14-18 percent lower than the procurement prices for rice has been reported in a few surveyed districts in Eastern Uttar Pradesh, for the agricultural year 1985-86.[14]

Thus, it is quite likely that farmers in Bihar are receiving prices which are much lower than the support prices and/or procurement prices announced by the government on account of inadequate infrastructure for purchase and storage of food grains. In contrast, farmers in Haryana are able to receive remunerative prices for their agricultural output, mainly on account of government infrastructural facilities. These differences have to be kept in mind while estimating the additional benefits to irrigation across regions and over time. A comparison of water rates with procurement prices may not reveal the true relationship between input and output prices.

Domestic prices versus import prices. Government policy on agricultural prices may be so designed as to protect consumers from high prices rather than allowing the producers to get higher prices through sales in deficit regions within the country or abroad (i.e., agricultural exports). The first objective may be achieved by "zoning," i.e., by restricting the movement of agricultural commodities from one state-zone to another.[15] In the case of wheat and rice, restrictions on imports and/or exports of food grains may result in domestic prices which are lower than the corresponding border prices. As pointed out in a recent study (Mishra 1985), the domestic prices of wheat and rice in India were much lower than their corresponding border prices in 1975 and 1980. For example, in 1980, the domestic price of wheat was US$177 per metric ton at the official exchange rate and US$142 at the shadow exchange rate. The corresponding border price was much higher at US$308 per metric ton.

[14]J. P. Singh, Personal Communication.

[15]Zonal restrictions were followed from time to time in India restricting free movement of food grains.

The negative values of nominal rates of protection show taxation of agriculture rather than protection of agriculture. This is also a method by which returns to the use of irrigation can be affected indirectly by macro policies of trade restrictions, 'zoning,' and other administrative controls. These should also be taken into account while analyzing various alternatives for raising resources from the agricultural sector. This is only to emphasize that raising of irrigation fees is only one (direct) method. Transferring resources from agriculture (or irrigated agriculture) 'to rest of the economy' can be done through policies which affect prices of outputs and inputs as well as through policies of direct and indirect taxation of incomes accrued or realized in the agricultural sector.

Terms of Trade between Farm and Non-farm Sectors

Changing the terms-of-trade between farm and nonfarm sectors is also one of the ways of transferring resources from one sector to another. By changing 'administered' prices of outputs and inputs, the government can influence resource flows from the farm sector to the government and/or to the manufacturers of agricultural inputs and implements and other commodities purchased by the farmers. A detailed analysis of commodity terms-of-trade in India has been reported in Rath (1985).

Table 6.20. Commodity terms of trade between farm and non-farm sectors in Bihar and Haryana (Rs/ha).

	Ratio of farm harvest prices to prices of inputs purchased from non-farm sector				Ratio of farm harvest prices to prices paid by rural households for goods of household consumption	
	(Index; 1961-62 = 100)				(Index; 1960-61)	
	Bihar		Haryana		Bihar	
	Rice	Wheat	Bajra	Wheat	Rice	Wheat
1970-71	143	117	89	138	109	88
1971-72	132	112	108	141	100	81
1972-73	144	138	187	135	102	96
1973-74	182	186	156	155	113	117
1974-75	183	111	131	112	182	108
1975-76	106	78	81	96	111	80
1976-77	116	92	82	103	94	73
1977-78	135	89	91	106	109	71
1978-79	115	89	81	107	88	68
1979-80	111	96	102	102	78	69
1980-81	96	86	94	91	82	75
1981-82	84	85	83	92	82	84
1982-83	120	103	81	92	111	97

Notes:

1. *Source*: Rath (1985)
2. Data on ratio of farm harvest prices to prices of household goods were not available for Haryana.

As may be noted in Table 6.20, the ratio of farm harvest prices to prices of inputs purchased from non-farm sectors has been on the decline since 1974-75 and has fallen to very low levels in 1980-81 and 1981-82. This is true for rice and wheat in Bihar and *Bajra* and wheat in Haryana. Although this ratio has been slightly higher in Bihar in 1982-83, it has declined or remained stagnant in the case of the two crops in Haryana.

Similar trends may be noted in the ratio of farm harvest prices to prices paid by rural households for goods of household consumption. The ratio of these prices has not only declined continuously (with the exception of the period 1977-78) since 1974-75, but has fallen much below that prevailing in 1960-61. Thus, the changes in farm harvest prices have not kept pace with increases in prices of inputs and other commodities purchased by farmers, and there has been a definite erosion in the 'purchasing power' of goods produced by the farm sector. These factors should be taken into account when considering raising of irrigation service fees to recover O&M expenses and capital costs. Such comprehensive analyses alone can ensure that both the productivity and equity aspects of benefits from irrigation projects are taken into account when formulating agricultural policies.

Incidence of Direct and Indirect Taxes on Incomes

Apart from irrigation service fees, farmers pay land revenue, agricultural income tax, and indirect taxes on commodities and services levied by the Central and State governments. The amount of indirect taxes paid by the farmer depends on the quantity and type of commodities purchased which, in turn, depend on the level of income or expenditure. An attempt has been made here to estimate the amount of indirect taxes paid by farmers who use canal irrigation as well as by farmers who do not use irrigation. The difference in the amount of indirect taxes paid by the two categories of farmers will provide an estimate of indirect taxes which could be attributed to provision of gravity irrigation. This difference in the total taxes paid will be considered as the indirect flow of financial resources as a consequence of higher incomes/expenditures generated by the use of irrigation.

Table 6.21 provides details of the assumptions made in calculating the incidence of indirect taxes. First, the area under the two categories of farms (1 ha and 2 ha) receiving canal irrigation in Bihar has been estimated. Thus, the total net area irrigated by canals (1.18 million ha) is divided as 0.48 million ha with an average farm size of 1 ha and 0.70 million ha with an average farm size of 2 ha. This gives the estimated number of households in each farm size as 0.48 and 0.35 million, respectively. Second, net income in each category is calculated based on the data used in Table 6.22. Per capita income or expenditure is then calculated assuming a) a family size of 6 adult-equivalents, b) that nonagricultural income will be, on average, equal to farm savings, and, thus, c) that net income from agriculture represents total consumption expenditure of the family. The amount of taxes paid per annum have been calculated using the estimates of per capita expenditure and the estimates made in a study conducted by the National Institute of Public Finance and Policy (NIPFP), New Delhi. This gives estimates of total indirect taxes paid by each farm family to the Central and State governments. For example, a farm family having, on average, a 1-ha irrigated farm would pay a tax of Rs 690 per annum. The estimated tax for a 2-ha irrigated farm is Rs 1,848 which is about 13.2 percent of the total income or expenditure per annum.

Table 6.21. Net income and incidence of indirect taxes in canal-irrigated farms in Bihar.

	Unit	Irrigated by canals		Unirrigated	
		1 ha	2 ha	1 ha	2 ha
1. Area under each category of farms	million ha	0.48	0.70	0.48	0.70
2. No. of farms in each category	million	0.48	0.35	0.48	0.35
3. Net income in each category of farm	Rs per ha per year	7012	14024	3869	7738
4. Per capita per income per expenditure[a] per annum	Rs	1169	2337	645	1290
5. Per capita income per expenditure in each category per month	Rs	97	194	54	108
6. Amount of tax Rs per capita per annum[b]					
-- Central taxes	Rs	73	196	24	73
– State taxes	Rs	42	112	16	42
Total	Rs	115	308	40	115
7. Total tax per annum for each farm family	Rs	690	1848	240	690
8. Total tax per annum for all the farms in each category	million Rs	331	647	115	241
9. Tax as percent of income over expenditure		9.8	13.2	6.2	8.9

[a]Taking a family size of 6 and assuming that non-agricultural income will balance savings and net income from agriculture will represent total consumption expenditure.

[b]The estimated tax incidence is determined on the basis of average expenditure per annum in each category.

[c]It is assumed that the level of incidence in 1983-84 will remain the same as in 1973-74.

Source: National Institute of Public Finance and Policy, New Delhi, Incidence of Indirect Taxation in India 1973-74, 1978.

The corresponding figures for unirrigated farms are Rs 115 for a 1-ha farm and Rs 241 for a 2-ha farm. These families pay 6.2 and 8.9 percent, respectively, of their annual income as indirect taxes. When these figures of tax payments per family are multiplied by the total number of farm families in each category, we get the estimates of total indirect taxes paid by these groups (Table 6.23). The total estimated taxes paid by farm families using canal irrigation are Rs 978 million (Rs 331 million+ Rs 647 million). The corresponding figure for families not using irrigation would be Rs 356 million (Rs 115 million+ Rs 241 million). Thus, the *additional* tax liability attributed to irrigation is Rs 622 million (Rs 978 million - Rs 356 million). According to the assumptions made and the estimates of tax incidence used in this study (based on the NIPFP study of 1973-74), around Rs 400 million is due

Table 6.22. Irrigation charges and net income (i.e., Returns to own farm resources) for a one-hectare farm in Bihar (using Cost of Cultivation Data).

	Rice		Wheat		Rice plus Wheat Canal Irrigation[a]	Rice plus Bajra Unirrigated[b]	Net Additional Income or Benefits from Irrigation
	Canal Irrigation	Un-Irrigated	Canal Irrigation	Un-Irrigated			
	1	2	3	4	5	6	(5-6)
1. Irrigation costs (Rs per ha)	74.7	-	79.24	-	130	-	
Kg unmilled rice/ha	46.7		49.5		81.3		
2. Net income (Rs/ha)	3284	1542	5325	3324	7012	639	4373
Kg unmilled rice/ha	2053	964	3328	2078	4383	1649	2733
3. Gross production (Rs/ha)	4616	2781	6612	4940	9244	4411	-

[a]For canal irrigation, the intensity of cropping was 170, i.e., 1 ha paddy+ 0.7 ha wheat.

[b]For unirrigated farm, the intensity of cropping was 13, i.e., 1 ha of paddy+ 0.33 ha wheat.

Source: Table 6.24.

Table 6.23. Incidence of indirect taxes on irrigated farms and total tax revenues in Bihar.

	Irrigated farm			Unirrigated farm			Additional taxes, i.e., taxes on irrigated farms minus taxes on unirrigated farm total
	1 ha farm	2 ha farm	Total	1 ha farm	2 ha farm	Total	
1. Incidence of central taxes	210	412	622	69	153	222	400
2. Incidence of State taxes	121	235	356	46	88	134	222
3. Total incidence of indirect taxes in 1984-85	331	647	978	115	241	356	622

Source: Table 6.21.

to indirect taxes levied by the Central Government (excise duties and customs duties) and Rs 222 million to State taxes (i.e., State excise, sales taxes, sales tax on motor fuel, motor vehicles tax, taxes on goods and passengers, entertainment tax, and electricity duty). These estimates have to be seen in the context of the following figures: In 1984-85, the share of Bihar from total Union excise duties was Rs 5,165 million; total State (Bihar) tax on commodities was Rs 4,372 million; and total revenue from indirect taxes in Bihar was Rs 9,537 million.

Estimates of Farmers' Ability to Pay for Irrigation Services

In this section, three approaches[16] are used to analyze the ability of farmers to pay for irrigation services. Under the first approach, irrigation's net benefits to water users (exclusive of payments related to irrigation services) are estimated. Benefit recovery ratios (the proportion of these net benefits which must be paid directly or indirectly) are calculated for alternative policies with respect to water charges. The second approach involves estimating the net income earned from irrigated cropping and comparing it with the magnitude of direct and indirect payments for water which would be required under alternative policies. The third approach compares irrigation-related payments with gross income earned from irrigated production. To facilitate comparisons with similar studies in other countries, all values have been calculated in terms of equivalent amounts of unmilled rice per hectare per year.

Table 6.24 presents data on gross income, farm expenditure, and net income of irrigated and unirrigated farms in Bihar. These data have been obtained from a farm-level survey conducted in the Sone River Basin in 1983-84 by the National Council of Applied Economic Research, New Delhi, which found that the intensity of cropping on a 1-ha farm in the region was 180, i.e., for a representative farm, one could assume 1 ha of rice plus 0.8 ha of wheat. Gross income on the 1-ha irrigated farm was estimated at Rs 8,438 compared with Rs 4,450 on an unirrigated farm. The estimate of net income per hectare per year has been presented as returns to all family resources (including land, labor, capital, and management) under the assumption that the family owns all the land farmed. Net income (returns to farm family resources) has been estimated at Rs 5,774/ha/year on irrigated farms, compared with Rs 3,263/ha/year on unirrigated farms. The net benefits of irrigation (i.e., after deducting increased production costs) are Rs 2,511/ha/year. Irrigation costs (or water rates or irrigation service fees) have been estimated at Rs 72/ha/year for this crop rotation. Then, irrigation costs are only 1.2 percent of the net income on irrigated farms and about 2.9 percent of the estimated net benefit from irrigation.

Similar estimates of net income and net benefit from irrigation have also been calculated from data obtained by the Ministry of Agriculture, New Delhi, under the studies on cost of cultivation of major crops. Analysis of farm-level data for the Sone Canal region is presented in Tables 6.22 and 6.25. The irrigation cost from these surveys is estimated at Rs 130/ha/year on canal-irrigated farms. Using an estimated intensity of cropping of 170 (i.e., 1 ha rice+ 0.7 ha wheat), the net income (i.e., returns to farm family resources) on an irrigated farm has been estimated at Rs 7,012/ha/year. The estimate of net income on an unirrigated farm is Rs 2,639 taking an intensity of cropping of 133 (i.e., 1 ha rice+ 0.33 ha wheat). This gives an estimated net benefit of Rs 4,373/ha/year from irrigation. It may be noted that this estimate of net benefit of irrigation is almost 75 percent higher than that estimated from NCAER (1985) data. Both these estimates have been used in evaluating alternative policies as indicated in Table 6.22 and Tables 6.26 through 6.30.

Similar estimates of water rates for canal irrigation and net income have been obtained from data given in a report on Economics of Farming in Haryana (1981-82) brought out by the Economic and Statistical Organization of the Government of Haryana. The estimates of water rates (Rs

[16] These approaches are adopted from the First Report of the Regional Study on Irrigation Service Fees by L. Small, M. Adriano, and E. Martin (1986).

Table 6.24. Gross income, farm expenditure, and net income of irrigated and non-irrigated farms in Bihar (Rs/ha).

	Irrigated			Unirrigated			Additional Net Income or Benefits from Irrigation
	Rice (1.0 ha)	Wheat (0.8 ha)	Total	Rice (1.0 ha)	Wheat (0.8 ha)	Total	
Gross Income[a]	5217	3221	8438	2434	2016	4450	3988
Farm Expenditure							
Fertilizers			1646			115	-
Irrigation cost			72	-	-		
Cost of materials (seeds, manure, fertilizers etc.)			2676			795	-
Total paid out expenses[b]			2664			1187	-
Net income (returns to farm family resources)			5774			3263	2511

[a]It is assumed that the intensity of cropping on a 1-ha farm is 180 (i.e., 1.0 ha of rice and 0.8 ha of wheat).

[b]Include paid-out cash expenses on purchased inputs only.

Source: NCAER (1985): Agro-economic and Socio-economic Survey of the Sone River Basin, 1985.

105/ha/year) and net benefit of irrigation (Rs 3,864/ha/year) are presented in Table 6.26.

Table 6.25. Irrigation costs, crop yields and net income by source of irrigation in Bihar.

		Canal irrigation	Tube wells etc.	Unirrigated
RICE				
No. of farms		23	22	14
Average area under crop (ha)		3.39	0.92	
Average cost of irrigation	Rs/ha	74.7	250.58	-
	Kg rice per ha	46.7	156.6	-
Yield (kg/ha)		2154	2280	1415
Net income[a]	Rs/ha	3284	3333	1542
	Kg rice per ha	2053	2083	964
WHEAT				
No. of farms		17	35	8
Average area under crop (ha)		2.6	0.92	
Average cost of irrigation	Rs/ha	79.24	329.15	-
	Kg rice per ha	49.5	205.7	-
Yield (Kg/ha)		2897	2254	2160
Net income	Rs/ha	5325	3254	3324
	Kg rice per ha	3328	2034	2076

[a]Net Income is defined as returns to own farm resources which correspond to Farm Business Income (Gross Income - Cost A2) as defined in the Farm Management Studies.

Source: Ministry of Agriculture, Government of India, Cost of Cultivation Studies, 1982-83. The data are for selected villages in Zone IV which includes *tehsils* in the Sone Command including Sasaram, Aurangabad, Hilsa, Arrah and Biharsharif.

Table 6.26. Irrigation charges and net income in selected farms in Haryana.

		Irrigated	Unirrigated	Difference of irrigated over unirrigated
1.	Gross income	8027	2664	5363
2.	Farm expenditure (purchased inputs only)	2023	524	1499
3.	Net income	6004	2140	3864
4.	Water rates	105	-	
5.	Tube well/pumping sets etc.	737	-	
	Sub-total of irrigation costs (4+ 5)	842		
	Irrigation costs as percent of gross income	10		
	Irrigation costs as percent of farm expenditure	42		
	Irrigation costs as percent of net income	14		
	Water rates as percent of additional income	3		
	Irrigation costs as percent of additional income	22		

Source: Economic & Statistical Organization, Government of Haryana, Economics of Farming In Haryana 1981-82, April 1985.

Recovery of O&M costs. These estimates of water rates and net income for Bihar and Haryana have been brought together in Table 6.27. Irrigation charges or water rates for canal irrigation range from 43 kg unmilled rice per hectare per year in Bihar to 98.1 kg in Haryana. Net returns to farm family resources range between 3,458 kg unmilled rice per hectare per year in Bihar and 5,709 kg in Haryana. Similarly, benefits from irrigation range between 1,504 kg unmilled rice per hectare per year in Bihar and 3,709 kg in Haryana. Total direct and indirect irrigation-related payments[17] by water users under alternative policy assumptions have been presented in Table 6.28. The first column of the table shows the average or typical amounts farmers are charged under current policies. The estimated water rates are equivalent to 43-81 kg unmilled rice per hectare per year in Bihar depending on the source of data used. For Haryana[18], the actual payment is equivalent to 98 kg unmilled rice per hectare per year.

[17]It should be mentioned that in India, under gravity irrigation systems water charges are paid in cash only. There are no contributions made in labor (or food grains) except in the case of some emergencies.

[18]These estimates of irrigation-related payments are nearer to those in Nepal and Thailand (based on an implicit tax of 6.2 percent on price of unmilled rice) which are 75kg unmilled rice per ha per year for Nepal and 85kg unmilled rice per ha per year for Thailand. These are much lower than the values for Korea, the Philippines and Indonesia. See Small et al. (1986).

Table 6.27. Irrigation charges and additional net income from irrigation (excluding irrigation charges from canal irrigation) in Bihar and Haryana.

	Irrigation charges		Net return to farm family resources from irrigated farm		Net return to farm family resources from unirrigated farm		Additional net income or benefits from irrigation	
	Rs/ha/year	kg rice/ha/year[a]	Rs/ha/year	kg rice/ha/year	Rs/ha/year	kg rice/ha/year	Rs/ha/year	kg rice/ha/year
Estimate I								
Bihar (1983-84)	72	43.1	5774	3458	3263	1954	2511	1504
	(130)	(81.3)	(7012)	(4383)	(2639)	(1649)	(4373)	(2733)
Haryana (1981-82)	105	98.1	6109	5709	2140	2000	3969	3709

[a]Farm harvest prices of unmilled rice have been used in computing kg rice per ha. These were Rs 1.67 per kg in 1983-84, Rs 1.60 per kg in 1982-83 in Bihar, and for Haryana they were Rs 1.36, 1.26 and 1.07 per kg each in 1983-84, 1982-83 and 1981-82, respectively.

Figures in parentheses are for data from cost of cultivation studies. These data are for 1982-83.

Sources: Tables 6.22 and 6.24.

Table 6.28. Total direct and indirect irrigation-related payments by water users under alternative policy assumption in Bihar and Haryana, (Kg rice per ha per year[a]).

	Actual	Actual modified to set irrigation service fees equal to O&M cost[b]	Actual modified to set irrigation service fees equal to O&M plus full recovery of capital cost[c]
Bihar[d] (1983-84)	43.1	80.8	1464
	(81.3)	(80.8)	(1464)
Haryana[e]	98.1	89.7	1869

[a]Farm harvest prices of rice used for computing kg rice per ha are: Rs 1.67 per kg in 1983-84 and 1.60 per kg in 1982-83 in Bihar; for Haryana, they were Rs 1.36, 1.26 and 1.07 per kg each in 1983-84, 1982-83 and 1981-82, respectively.

[b]O&M costs for Bihar are for 1983-84, Rs 135 per ha consisting of Rs 93.4 per ha for Operation & Maintenance and Rs 41.6 per ha. O&M costs for Haryana are for 1982-83 as given in Table C.3 i.e., Rs 113 per ha for total working expenses on irrigation projects.

[c]Capital costs used are: Rs 22900/ha for Bihar; Rs 22230/ha for Haryana (See Text). Capital Recovery Factor (CRF) used to amortize capital costs is:

$$CRF = \frac{i(1+i)^n}{(1+i)^n - 1}$$ where i is the interest rate (10%) and n is the life of the project (50 years).

$$= \frac{1}{0.100859} = 9.91481$$

These figures give amortized (annual) capital costs of Rs 2312 per ha for Bihar and Rs 2242 per ha for Haryana.

[d]Figures in parentheses are based on data from cost of cultivation studies conducted by the Ministry of Agriculture, New Delhi. These data are for 1982-83.

[e]For Haryana, the irrigation rates are for 1981-82 while O&M costs are for 1982-83. These have been converted to Kg rice/ha using farm harvest prices of the corresponding year. On account of this, the quantity of rice required to cover O&M costs declines even though the O&M costs per ha at Rs 113 are higher than the average water charges of Rs 105/ha.

Sources: Tables 6.22 and 6.27.

The second column of Table 6.28 shows the estimated amounts that would be needed if current policies are modified so that irrigation service fees per hectare would equal the costs of O&M. This represents the level of payments that would be necessary to provide full recovery of O&M costs via an irrigation service fee, assuming that collection rates are 100 percent. The last column of the table indicates the charges necessary for the per hectare amounts charged to equal the full cost of both O&M and capital investment. It should be noted that increases in irrigation fees amounting to 97 percent are indicated in Bihar if one uses the irrigation charges paid by farmers indicated in the National Council of Applied Economic Research survey. However, for recovering O&M costs, no increase is indicated if the actual irrigation charges are based on cost of cultivation studies. In Haryana, the actual amounts reportedly paid by farmers are about 10 percent higher than the average O&M costs. Thus, full recovery of O&M costs does not indicate any increase in water rates (it suggests a decrease of 9 percent) but would require higher collection efficiencies. However, water rates would have to be increased substantially (i.e., 18-34 times in Bihar and 19 times in Haryana) if full cost of both O&M and capital investment is to be recovered.

Table 6.29. Estimated benefit recovery ratios under alternative financing policies (in percent).

	Actual	Actual modified to set[b] irrigation service fees equal to O&M cost	Actual modified to set[b] irrigation service fees equal to O&M cost plus full recovery of capital cost
Bihar[a]	2.9	5.4	97.4
	(3.0)	(3.1)	(55.9)
Haryana	2.6	2.8	59.3

[a]Figures in parentheses are based on data on cost of cultivation studies conducted by the Ministry of Agriculture, New Delhi.

[b]O&M costs are: Rs 135 for Bihar and Rs 113 for Haryana (per ha) amortized capital costs are Rs 2,310 for Bihar and Rs 2,242 for Haryana (per ha).

Sources: Tables 6.22, 6.27 and 6.28.

Benefit recovery ratios. From the figures given in Tables 6.22 and 6.27, estimated benefit recovery ratios under alternative policies for Bihar and Haryana have been displayed in Table 6.29. Under actual policies (and water rate levels), the estimated benefit recovery ratio is around 3 percent for Bihar and 2.6 percent for Haryana.[19] For full recovery of O&M costs, the estimated benefit recovery ratios rise for both the States, although marginally for Bihar (Estimate II in parenthesis) and Haryana. The last column in Table 6.29 shows that the benefit recovery ratio would be almost 100 percent in Bihar if the net benefit to irrigation is similar to that estimated in the National Council of Applied Economic Research survey. However, with a higher figure of net benefit of irrigation (based on cost of cultivation study), the benefit recovery ratio to cover full costs of O&M and capital investment is 55.9 percent for Bihar, and for Haryana, 59.3 percent.

[19]These may be compared with 5 percent for Nepal, 10 percent for the Philippines and 26 percent for Korea reported in those studies in this volume.

Based on the estimates presented in Table 6.29, it can be said that in both the States, wherever there is a reasonable irrigation service, the incremental benefits derived from irrigation will be adequate to make possible the full recovery of irrigation O&M costs and still leave the farmers with significant increases in net income due to irrigation. Table 6.29 also indicates that the benefits of irrigation are not high enough to make possible the full recovery of O&M plus capital costs and leave enough margin for the farmer to use irrigation[20].

Net income from irrigation. In Table 6.30, the estimates of net income (derived in Tables 6.24, 6.22, and 6.26) are compared with the amounts of irrigation-related payments required under the three alternative policies. The comparison is presented as the amount of the payment as a percentage of the net income remaining with the water user after payment has been made. Under the actual policies of the two States, the estimates range between 1.2 and 1.8 percent for Bihar and 1.7 percent for Haryana. Raising irrigation service fees to cover O&M costs results in relatively modest changes in the percentage of net income needed to pay for water, except in the case of Bihar (Estimate I, using the National Council of Applied Economic Research Survey). The percentage of net income needed to cover O&M costs remains less than 2 in both States. However, raising irrigation service fees still further to cover the full capital costs as well as O&M costs leads to irrigation charges generally in the range of 35-43 percent of net income of the farmers. The implications of the figures of Table 6.30 are generally consistent with conclusions drawn from Table 6.29, namely, that farmers generally have the ability to pay for the full cost of irrigation O&M through irrigation service fees, but the payment of the full capital cost is not feasible.

Table 6.30. Total direct & indirect irrigation-related payments by water users as a percent of the net returns to the farm family resources[a] under alternative policy assumption (percent).

	Actual	Actual modified to set irrigation service fees equal to O&M cost	Actual modified to set irrigation service fees equal to O&M plus full recovery of capital cost
Bihar[b]	1.2	1.9	42.8
	(1.8)	(1.9)	(34.9)
Haryana	1.7	1.9	39.2

[a]Net income estimates are presented as returns to all family resources (including land, labor, management and capital) under the assumption that the family owns all of the land farmed. These estimates of net income are compared with the amounts of irrigation-related payments required under the three alternative policies. The comparison is presented as the amount of the payment as a percentage of the net income remaining with the water user after payment has been made.

[b]Figures in parentheses are based on data from cost of cultivation studies.
Source: Table 6.22.

Payments as a percentage of gross income. Comparisons of payments for irrigation services with gross income are conceptually less meaningful than either of the previous two approaches to analyze farmers' ability to pay, but they avoid the need for data on farm income, which often are limited to a

[20]In this case, the situation in Indian States is similar to those in Nepal and the Philippines assuming moderate capital costs.

few specific surveys or projects. Estimates of the typical percentages of gross income which are required as payments for irrigation under the three alternative policy situations are presented in Table 6.31. Under the actual policies, these range between 0.9 and 1.4 percent, and if water charges are raised to cover O&M costs the range is between 1.4 and 1.6 percent. However, about 30 percent of the gross value of output would have to be paid if irrigation service fees are raised to cover O&M costs as well as full capital investment.

Table 6.31. Total direct & indirect irrigation-related payments by water users as a percent of gross production[a] under alternative policy assumption (in percent).

	Actual	Actual modified to set irrigation service fees equal to O&M cost	Actual modified to set irrigation service fees equal to O&M plus full recovery of capital cost
Bihar[b]	0.9	1.6	28.9
	(1.4)	(1.5)	(26.5)
Haryana	1.3	1.4	29.3

[a]Gross production refers to gross value of output on a one-ha irrigated farm assuming two crops of rice and wheat. In Bihar, the intensity of cropping is 180, i.e., 1 ha of rice+ 0.8 ha of wheat. In Haryana, the intensity of cropping is 170, i.e., 1 ha of rice+ 0.7 ha of wheat.

[b]Figures in parentheses are for data from cost of cultivation studies of the Ministry of Agriculture, New Delhi.

Sources: Tables 6.22 and 6.27.

Table 6.32. Water rates, gross value per ha and cost of irrigation in Bihar and Haryana in the late sixties (1969-70/1970-71).

		Bihar		Haryana	
		Rice	Wheat	Rice	Wheat
1.	Water rate (Rs per ha)	37.5	22.5	24.4	14.5
2.	Yield per ha (Kg)	926	940	1433	1822
3.	Harvest price at farm level (Rs per quintal)	59.63	87.02	53.96	69.27
4.	Value of produce per ha (Rs)	553	818	773	1262
5.	Water rate as percent of gross value of produce	7.0	2.7	3.1	1.1
6.	Gross value of produce per ha[1] (Rs)	1207			
7.	Estimated cost of O&M plus capital charges for irrigation projects[2]	123		66	
8.	Water rates[3] (as modified to cover O&M plus capital charges) as percent of gross value of produce	10.2		4.0	

Notes:

[1] Gross value of produce has been estimated by assuming two crops of rice and wheat on an irrigated farm. In Bihar, the intensity of cropping is 180, i.e., 1 ha of rice plus 0.8 ha of wheat. In Haryana, it is 170, i.e., 1 ha of rice plus 0.7 ha of wheat.

[2] The O&M costs (for 1970) were estimated at Rs 15 per ha. The capital costs for continuing schemes for Bihar were estimated at Rs 1,067 per ha, the amortized value of which at 10 per cent interest and 50 year life was Rs 108 per ha. The capital costs of continuing schemes for Haryana were estimated at Rs 507 per ha, the amortized value of which was Rs 51 per ha. Thus, the O&M plus capital costs of Bihar and Haryana were estimated at Rs 123 per ha and Rs 66 per ha, respectively.

[3] These water rates for rice are marginally different from those used in Table 6.33 due to differences in sources of data.

Source: Government of India, Report of the Irrigation Commission, 1972, vol. I, pp. 270-271.

It is interesting to compare these estimates with those obtained around 1970 and reported by the Irrigation Commission (1972). As shown in Table 6.32, water rates in Bihar were 7 percent of the gross value of produce in the case of rice and 2.7 percent in the case of wheat, giving a weighted average of 4.6 percent. This figure is much higher than the estimates ranging between 0.9 and 1.4 percent in the early eighties. This shows that in the early seventies, a much higher proportion of gross value of produce was collected as water charges, and this ratio has declined significantly over the decade. Similarly, water rates of Rs 55/ha were much higher than the estimated O&M costs of Rs 15/ha. In Haryana, water rates were relatively lower for both crops, and the weighted average (assuming intensity of cropping of 170) was Rs 34.6/ha which was only 2.1 percent of the gross value of produce. This ratio has declined to 1.3 percent over the decade (Table 6.31).

As shown in Table 6.32, in the early seventies, water rates as modified to cover O&M charges and annualized capital costs of irrigation projects would have been 10.2 percent of the gross value of produce in Bihar. This percentage is much lower than the range of 26.5-28.9 percent estimated for the early eighties. The corresponding figures for Haryana are 4.0 percent for the early seventies and 29.3 percent for the early eighties. This shows that the increase in gross value of produce has been much less than the increases in O&M expenses and capital costs. In other words, the increases in capital costs of surface irrigation projects have been so high that covering these costs by raising irrigation service fees would not be possible. Although these figures may not be strictly comparable on account of differences in assumptions and sources of data, they do point toward the trends in increases in costs of irrigation vis-a-vis the gross value of output from irrigated agriculture.

Table 6.33. Water rates in Bihar for perennial and non-perennial crops (Rs per season per ha).

	Perennial (Sone Canals)		Non-perennial (Canals other than Sone)	
	Kharif (Rice)	Rabi (Wheat)	Kharif (Rice)	Rabi (Wheat)
At current prices				
1965-66 (since 1953)	25	12	20	10
1972-73 (since 1966)	40	22	20	17
1973-74	52	30	27	22
1974-75	78	45	41	35
1982-83	78	45	41	35
1984-85	90	51	47	38
In real terms (adjusted for wholesale prices of rice & wheat 1970-71 = 100)				
1966 to 1972				
1973-74	37	28	19	20
1974-75	43	25	22	19
1982-83	30	21	16	16
1983-84	27	21	14	16
1984-85	33	24	18	19

Sources: 1. Central Water Commission, Government of India, for water rates.
2. Wholesale price indices for rice and wheat are from the Economic Survey (1985-86) as reported in Table 6.41.

The conclusions from the above analysis can be summarized as follows:

a) Increasing irrigation service fees or water rates to cover O&M costs results in moderate increases in the proportion of the gross value of output (or net irrigation benefit) that must be paid.

b) Attempting to raise the irrigation service fees further to cover the full capital cost, would require payment of a very high proportion of the crop — between 27-30 percent.

c) Raising irrigation services fees to cover both O&M costs and capital investment may result in disincentives for use of water for irrigation resulting in lower output, incomes, and employment. Hence, policies regarding water rates should be thoroughly evaluated in terms of their impact on welfare of the farmers, incentives to use water and other inputs, and on agricultural output, employment, and income distribution.

METHODS OF FINANCING IRRIGATION SERVICES

The water charge for a crop is usually a charge per hectare of area under the crop. The crop-area basis has been adopted for irrigation water charges because it is convenient for measurement. Besides, in almost all irrigation systems, facilities for measuring water quantities on a volume basis are absent. The advantages and disadvantages of the crop method have been discussed by experts and field engineers. According to them "the crop method does not offer any economic incentive to a cultivator to be more frugal with the use of water or to pay any heed to such water management practices as are recommended by experts" (Malhotra 1985:63; Malhotra 1982; Government of India 1972).

The most prevalent method of water charges, both in Bihar and Haryana, is the crop method under which water charges are levied on an area basis for different crops irrigated in any year[21]. Table 6.33 gives figures for water rates for two major crops — rice and wheat -- over time in Bihar. It may be noted that in 1984-85, the water rate (or irrigation charge) for rice (*Kharif*) was 80 percent higher than that for wheat in perennial canals such as the Sone canal system. The water rates for nonperennial canals (other than Sone) were nearly equal for rice and wheat. The water rate for rice has increased from Rs 25/ha during 1953-65 to Rs 90/ha in 1984-85. The corresponding figures for wheat are Rs 12/ha and Rs 51/ha. Thus, in nominal terms, the water rate for rice has increased 3.6 times over the last 20 years, while for wheat it has increased 4.25 times over the same period. The data also show the stickiness in revising water rates. These did not change at all over a 13-year period 1953-1965 or during the decade 1974-1983. The most recent increase has been of 13 to 15 percent in the year 1984-85.

[21]In Haryana, some experiments have been made with the *Wari-metric* method which is said to be a proxy for the volumetric method under conditions where the *Warabandi* (rotational) system of water distribution is used. The Wari-metric method of assessment was introduced on Sotha Distributary in the Hissar District with effect from Kharif 1976. "The price of unti time of *Wari* (turn) for each water course can be fixed in several ways, but in this particular case it was fixed in a manner so that the level of taxation remained the same as with the crop method. The average of 3 years assessment of each water course was divided by its net *Wari* (turn) time to get the price of unit time of *Wari* with no regard to number of times a cultivator received his water." Under *Wari-metric* method, field-to-field collection of crop data for preparation of water bils is not necessary, as the water bill can now be prepared with data already available in the office.

The experience of the Sotha Distributary, where the *Wari-metric* method is still continuing, has not been critically evaluated. The experiment did not privide any apparatus for observing whether this method provided any inducement to cultivators for better and more economic use of water. However, the "enquiries made from cultivators after 4 years reveal that they are happy because for their water bill they have no longer to depend upon the integrity and efficiency of any one individual" (Malhotra 1985, p. 73.).

However, when the changes in water rates are adjusted for changes in the wholesale prices of rice and wheat, respectively, one finds that the water rates in real terms have not increased at all during the last decade. In fact, these have declined by 11 percent for rice and 14 percent for wheat in the case of perennial canals.

Water rates in Bihar are charged on the basis of a season (involving three waterings) or of a single watering[22]. The rates for a single watering are about 80 percent of those for the season in the case of rice, but are almost equal in the case of wheat (Table 6.34). The water rates to be charged by the State tube wells for 3 waterings to rice (in 1984-85) were Rs 125/ha, about 37 percent higher than those for canal irrigation. The water rates for wheat under State tube wells may turn out to be higher by 40-140 percent, depending on the number of waterings required.

Table 6.34. Water rates in Bihar for crops in three seasons for Perennial Flow Canals.

	1951	1953-65	1966-72	1973	1974-83	1984-85
Kharif						
1. *Sone Canals (perennial)*						
Long lease	11.12	22.24	37.07	49.42	74.13	
Season	12.36	24.71	39.54	51.89	77.84	90.50
Single watering	6.18	12.36	22.24	29.65	44.48	51.15
2. Non-perennial canals						
Long lease	n.a.					
Season		19.77	19.77	27.18	40.77	47.50
Single watering		12.36	12.33	17.30	25.95	29.90
Rabi						
1. *Sone Canals (perennial)*						
Season	8.03	12.36	22.24	29.65	44.48	51.15
Single watering			19.77	27.18	40.77	46.95
2. Non-perennial canals						
Season	n.a.	9.88	17.30	22.24	35.36	38.50
Single watering			12.36	17.30	25.95	29.90
Hot weather						
1. *Sone Canals (perennial)*	n.a.					
Season		44.48	69.19	91.43	137.15	159.50
Single watering		14.83	24.71	32.12	48.19	55.35
2. Non-perennial canals						
Season		9.88	44.48	59.30	88.96	103.50
Single watering		3.71	14.83	19.77	29.65	34.10

Source: Central Water Commission, Ministry of Irrigation, Government of India.

[22]About five years ago, the long lease system of charging for watering was abolished because influential farmers were monopolizing the use of water by local maneuvering or by force. On account of this, there was abnormal growth of litigations. Hence, the long-lease system was replaced by seasonal or single waterings.

Table 6.35 presents data on water rates in Haryana. It may be noted that water rates have been raised only once during the last decade or so. In real terms (i.e., after adjusting for changes in wholesale prices of rice and wheat) the water rate for rice in 1983-84 was only Rs 25/ha compared with Rs 74/ha at current prices. Similarly, for wheat, although the nominal water rates have remained between Rs 45-62/ha, in real terms these have declined to a range of Rs 15-21/ha.

Table 6.35. Water rates in Haryana for storage schemes and diversion schemes.

At current prices	Storage scheme (Bhakra-Nangal Project)		Diversion schemes[a] (Flow irrigation)	
	Kharif (Rice)	Rabi (Wheat)	Kharif (Rice)	Rabi (Wheat)
1966-67 (since 1949-50)	24	15	24	15
1975-76 (since 1966-67)	74	62	74	45
1983-84	74	62	74	45
In real terms (adjusted for wholesale prices of rice and wheat 1970-71 = 100)				
1975-76	41	35	41	25
1983-84	25	21	25	15

[a]The schemes included are Western Jamuna Canal (WJC) Remodeling Scheme, Laharu Lift Irrigation Scheme and Jui Lift Irrigation Scheme.

Sources: Central Water Commission, Statistics Directorate, New Delhi. For water rates, Wholesale Price Indices are from Economic Survey Reports.

Assessment, Billing, and Collection Procedures

Every year, in Bihar, the irrigated area of each farmer under each crop is assessed by revenue staff in the field. A collection peon moves from door to door to contact each farmer for collection of arrears and current charges with a blank receipt book. The farmer can make payment in full or in part, and the collection peon is required to issue a receipt for the amount paid. Certificate proceedings (in courts) are initiated against farmers for pending charges, and warrants are issued against defaulters. In such cases, surcharge and interest are also realized from the farmers along with the outstanding charges.

In Bihar, there is an elaborate organization for irrigation revenue administration in the Irrigation Department. At present the Revenue Administration of the Irrigation Department is organized in a pyramidal structure. The tehsil constitutes the lowest unit of the organization. Two or more tehsils comprise a Revenue Circle or *anchal*. Several anchals comprise a Division. On average, there are seven to eight Circles in a Division. The Directorate of Revenue Administration consists of 18 such Divisions and is a part of the Secretariat Complex of the Irrigation Department of the Government of Bihar.

In 1984-85, in Bihar, the numbers of *sangrahak* (collection peons) *moharrirs* and *amins* were 2,494, 840 and 246, respectively. In addition, there were 98 *tehsildars* who supervised the work of revenue collection. In 1983-84, the number of field staff was much larger: 3,170 collection peons, 1,234 moharrirs, 159 tehsildars, and 427 amins. Invariably, it has been found that persons actually employed are in excess of the sanctioned numbers. In September 1984, an evaluation showed that the excess staff comprised 197 clerks, 45 moharrirs, and 143 amins.

A recent review of the revenue administration carried out by the Directorate has suggested that there is urgent need to: a) redefine the jurisdiction of the existing 18 divisions to bring about a balance between assessed area in each division, b) review existing work loads of field staff and supervisory staff, and c) suggest norms for work load of permanent and seasonal staff.

In Haryana, the particulars of the crops sown along with the names of the cultivators are recorded in a register called *khasra*. "This register is the initial record of the area irrigated and all disputes about the irrigation status of a particular piece of land are decided on its basis. This record is recognized by the courts and hence the necessity for its maintenance according to rules. Thus the importance of an Irrigation Booking Clerk who maintains this initial record can well be imagined." Although the rules provide a number of checks on the work of Irrigation Booking Clerks by the *zilladar*, the Deputy Collector, the Sub-Divisional Officer, and the Executive Engineer, in practice, the crop method of water charges places great reliance on the efficiency and integrity of the Irrigation Booking Clerk.

Collection efficiency and costs. Table 6.36 presents data on current charges, arrears, and collection of irrigation fees in Bihar for the years 1982-83 to 1984-85. It may be noted that the arrears of irrigation charges are between Rs 225-250 million for the last three years. These are around three times more than the current charges in these years. In 1982-83, current charges for irrigation totaled Rs 71 million while the charges for industrial water supplied to Bokaro Steel Limited were Rs 26 million. The assessed charges for irrigation have declined to Rs 62.4 million in 1984-85, partly because of a decline in area irrigated and partly because of lower average rates. The assessment for industrial water supply in 1984-85 is also much lower at Rs 10.2 million, a reduction of 60 percent in two years.

As described earlier, the Government of Bihar has an elaborate setup of revenue administration in the Irrigation Department. Expenditure on revenue establishment, which represents the cost of collection of water rates, was Rs 60 million in 1982-83 and increased to Rs 63.7 million in 1984-85 (Table

Table 6.36. Year-wise demand, collection and expenses on revenue administration in Bihar : 1982-83 to 1984-85 (in Rs million).

	1982-83			1983-84			1984-85		
	Irrigation	Bokaro Steel	Total	Irrigation	Bokaro Steel	Total	Irrigation	Bokaro Steel	Total
1. Arrears[a]	223.0	0	223.0	256.0	2.3	258.3	251.9	0	251.9
2. Current demand	71.0	26.0	97.0	73.5	12.4	85.9	62.4	10.2	72.6
3. Total demand (including arrears) (1+ 2)	294.0	26.0	320.0	329.5	14.7	344.2	314.3	10.2	324.5
4. Target of collection	n.a.	n.a.	n.a.	327.7	16.5	344.2	184.3	n.a.	184.3
5. Total collection (actual)	53.4	23.7	77.1	49.5	14.7	64.2	48.3	9.5	57.7
6. Expenditure on revenue establishment[b]	60.0	0	60.0	59.0	0	59.0	63.7	0	63.7
7. Actual collection *minus* expenditure on revenue establishment	-6.6	23.7	17.1	-9.5	14.7	5.2	-15.5	9.5	-6.0
8. Expenditure on revenue expenditure as percent of annual collection	112	0	78	119	0	92	132	0	110
9. Actual ellection as percent of target	18	92	24	15	89	19	26	n.a.	31
Area assessed under irrigation (million ha)	1.42			1.48			1.32		
Actual collection per ha (Rs)	37.6			33.4			36.5		
Revenue expenditure per ha (Rs)	42.2			40.0			48.1		

[a]The figures of arrears from one year to the other are not consistent with those obtained from estimates of demand and collection.

[b]Figures of expenditure on revenue establishment are marginally different from those obtained from budget papers.

Source: Government of Bihar, Irrigation Department.

6.36). These costs are quite high when compared with the actual collection or current assessment. For example, in 1982-83, costs of collection were about 78 percent of the total revenue from irrigation projects. Because revenue from industrial water supply to the Bokaro steel plant was a significant proportion of the total revenues (31 percent), the total collection from irrigation charges at Rs 53.4 million was about 10 percent less than the expenditure on revenue establishment of Rs 60 million. Since collection of charges from Bokaro Steel Limited does not require any revenue establishment, one can conclude that *if* water charges were abolished and the Directorate of Revenue Administration disbanded, the State Government would have benefited to the extent of Rs 6.6 million (Table 6.36).

The figures for 1983-84 and 1984-85 also show the same thing, i.e., the costs of collection of irrigation charges are higher than the revenues obtained from farmers for providing irrigation services[23]. In fact, the deficit has increased from Rs 9.5 million in 1983-84 to Rs 15.5 million in 1984-85. Thus, abolition of water charges, and retrenchment of the staff on revenue administration would have provided the State Government with additional funds of Rs 31.6 million during the years 1982-83, 1983-84, and 1984-85. This would have been over and above the Rs 47.9 million collected from Bokaro Steel Limited during the 3-year period.

Thus, the increasing expenditure on revenue administration should be treated as a means of providing employment to a large number of people rather than as a cost towards providing irrigation services. Hence, it would be unfair to raise water rates to cover the ever-increasing expenditure on revenue administration when this expenditure does not result in improvement in irrigation services, but reflects a welfare measure to provide employment which, as such, is politically motivated. It is in this context that the possibilities of collecting water rates along with land revenue or through enhanced land revenue on irrigated land should be considered. If this is politically difficult, it may be useful to explore the possibility of recovering irrigation charges through a tax on the use of fertilizers, after a careful analysis of the impact of this tax on the incentive to use fertilizers and resulting impacts on crop yields.

It should be noted that irrigation charges actually collected in 1982-83 were Rs 37.60/ha as compared with the current charges (average) of Rs 50/ha. The actual collection declined to Rs 33.40/ha in 1983-84 and Rs 36.50/ha in 1984-85 (Table 6.36). This is to be compared with Rs 49/ha and Rs 47/ha of current charges in the two years, respectively. As compared with these figures, the expenditure on revenue administration was Rs 42.20/ha in 1982-83, Rs 40/ha in 1983-84 and Rs 48.10/ha in 1984-85. This shows that in 1984-85, the revenue expenditure per hectare was higher than even the assessment of irrigation charges. Hence, even if the rate of collection were 100 percent for current charges, the State Government would have incurred a deficit. Given that the actual collection from irrigation was Rs 14 million short of current charges, collection efforts resulted in increasing the arrears rather than decreasing them.

O&M expenses and receipts for two major projects. Table 6.37 contrasts the situation of net receipts in the case of two major projects, Kosi and Sone canals. Eastern Kosi Canal and the Rajpur Canal, which were begun during the First Plan (1951-56) and the Third Plan (1960-65), respectively, were completed during the Sixth Plan (1980-85). The Sone canal system, which existed before 1951, was strengthened by building the Sone Barrage and remodeling works by 1972-73. Sone High Level Canal, which was begun during 1966-69, was also completed at the end of the Sixth Plan. The total O&M costs of Kosi are almost twice those for Sone, even though the irrigation potential created and utilized is estimated to be lower in the Kosi canal systems[24]. The share of establishment costs to total O&M is around 40 percent in the Kosi system and 45 percent in the Sone system.

[23]It may be noted that in Bihar, the cost of establishment for collection of land revenue is also higher than the actual collection of land revenue.

[24]Data on potential created and utilized by each project were difficult to obtain. Sone Canal is estimated to be irrigating about 0.50 million ha. The potential created by Eastern Kosi Canal and Rajpur Canal are estimated at 0.46 million ha. The potential utilized up to 1980 was about 50 percent of the total created. This is the major reason for relatively higher util costs of the Kosi system.

Table 6.37. Expenses[a] and receipts for Kosi and Sone River Projects: 1984-85 (in Rs million).

	Kosi	Sone
Expenses		
Establishment costs	20.8	11.1
Works	30.1	13.4
Total O&M costs	50.9	24.5
Receipts		
Gross receipts	19.0	60.6
Cost of revenue establishment	24.1	39.5
Net receipts	-5.1	21.1
Net receipts as percent of O&M costs	Negative	86
Percentage increase in water charges (actually collected) to cover O&M costs	295	16

[a]These figures are marginally different from those obtained in the Budget papers.
Source: Irrigation Department, Government of Bihar.

Gross receipts from the Kosi system are only Rs 19 million compared with Rs 60.6 million in Sone. After deducting the cost of revenue establishment, the net receipts are negative (Rs -5.1 million) for Kosi, but positive (Rs 21.1 million) for Sone. Net receipts covered 86 percent of the total O&M costs in the Sone system. It has been estimated that in order to cover the entire O&M costs, gross receipts (or water charges actually collected) would have to go up by 300 percent in the case of the Kosi system. The corresponding estimated increase necessary is only 16 percent for the Sone canal system.

The financial performance of state tube wells is shown in Table 6.38. While total O&M expenses increased from Rs 106 million in 1981-82 to Rs 149 million in 1984-85, total revenues collected by the Bihar Water Development Corporation declined from Rs 0.77 million to Rs 0.56 million. Thus, the net losses from the operation increased from Rs 105 million in 1981-82 to Rs 148 million in 1984-85. In 1984-85 revenue collection accounted for only 0.4 percent of total O&M expenses. Average revenue was Rs 15.7/ha while the area irrigated per state tube well was 16.2 ha. The estimated revenue per tube well was Rs 254 as against an estimated O&M cost of Rs 4,244.

Table 6.38. Financial performance of public tube wells in Bihar.

	1981-82	1984-85
No. of tube wells in working condition	3364	2167
Total revenue collection (Rs. million)	0.77	0.56
Total expenses on O&M (Rs. million)	106	149
Net losses (Rs. million)	105	148
Revenue collection as percent of total expenses	0.7	0.4
Area irrigated per TW (ha)	24.7	16.2
Revenue per ha (Rs)	9.3	15.7
O&M expenses per ha (Rs)	1276	4244

Source: Bihar Water Development Corporation, Patna.

Table 6.39. Net receipts from multipurpose and major and medium irrigation schemes (excluding flood control schemes) in 1981-82, (in Rs lakhs).

State	Gross receipts	Working expenses	Net expenses
Andhra Pradesh	2534[a]	2172	+ 362
Assam	55	61	6
Bihar	729	1901	-1172
Gujarat	785	1169	- 384
Haryana	1082	1880	- 798
Himachal Pradesh	-	-	-
Jammu & Kashmir	24	173	- 148
Karnataka	832	1096	- 264
Kerala	131	624	- 493
Madhya Pradesh	587	1312	- 725
Maharashtra	1325	1394	- 69
Manipur	5	6	- 1
Meghalaya	-	-	-
Nagaland	-	-	-
Orissa	408	861	- 453
Punjab	1064	1835	- 771
Rajasthan	866	1746	- 880
Sikkim	-	-	-
Tamil Nadu	348[b]	1064	- 716
Tripura	-	-	-
Uttar Pradesh	3941	2565	+ 1376
West Bengal	85	1553	- 1468
Total	14801	21412	- 6610

[a]Includes an estimated amount of Rs 2372 lakhs attributable to irrigation but shown under Land Revenue.

[b]Includes Rs 2.54 lakhs attributable to irrigation but shown under Land Revenue.

Source: Government of India: Report of the Eighth Finance Commission, 1984, Annexure III-19, p 199.

In contrast, gross receipts, both direct and indirect, increased by 27 percent, at current prices, over the seven-year period indicating that these have declined significantly in real terms (deflating by wholesale price index of all-commodities). Compared to Rs 85 million in 1975-76, these declined to Rs 66 million in real terms, a decline of 23 percent. Thus, in real terms, gross receipts which accounted for 74 percent of the total working expenses in 1975-76, contributed only 52 percent of the total in 1981-82. Gross receipts per hectare, at current prices, averaged Rs 35 in 1973-74, Rs 50 in 1975-76, and Rs 43 in 1982-83. In real terms, gross receipts per hectare declined from Rs 50 in 1975-76 to Rs 26 in 1982-83, i.e., almost by one-half over an eight-year period.

A juxtaposition of these O&M costs and expenses on revenue collection with the receipts from irrigation projects provides valuable insights into irrigation financing in the State of Bihar. Table 6.8 shows that the total receipts from irrigation projects (including multipurpose projects) was Rs 126.4 million in 1984-85. After deducting the cost of revenue establishment of Rs 70.7 million, the net revenue from these projects was Rs 55.7 million. This accounted for only 33 percent of the total O&M costs of Rs 167.6 million. Thus, net receipts from the operation of irrigation projects was negative, i.e., Rs -116.4 million or Rs -56.5 per ha. These figures have to be seen in the context of net receipts of Rs -117.2 million (Rs 73 million - Rs 190 million) for Bihar in 1981-82 as reported by the Eighth Finance Commission (Table 6.39).

Table 6.40 shows gross receipts (at current prices) from irrigation works in Haryana. Note that while gross receipts increased by 42 percent over the decade 1973-74 to 1982-83, gross receipts per hectare increased only by 23 percent. In real terms (i.e., deflated by Wholesale Price Index 1975-76 = 100)

Table 6.40. Gross receipts and working expenses of irrigation projects in Haryana : at current prices; 1973-74 to 1982-83.

	Gross receipts per ha (Rs)	Working expenses per ha (Rs)	Gross area irrigated (million ha)	Gross receipts (direct & indirect) (Rs million)	Working expenses (direct & indirect) (Rs million)	Gross receipts as percent of of working expenses
1	2	3	4	5=3 4	6=3 2	7=4 2
1973-74	1.626	57	64	89	35	39
1974-75	1.513	50	95	54	33	63
1975-76	1.694	85	115	74	50	68
1976-77	1.535	111	101	110	72	66
1977-78	1.540	89	116	77	58	75
1978-79	1.667	95	131	73	57	79
1979-80	1.673	80	164	49	48	98
1980-81	1.818	101	181	56	56	100
1981-82	1.892	108	207	52	57	109
1982-83	1.865	81	211	38	43	113
Percent increase 1982-83 over 1973-74	15	42	229	--	23	190

Source: Statistical Abstract of Haryana (1983-84); Government of Haryana, 1985.

gross receipts, instead of increasing, have declined from Rs 85 million in 1975-76 to Rs 66 million in 1981-82 (Table 6.12). Gross receipts per hectare, at current prices, remained around Rs 50/ha in 1982-83. Gross receipts covered only 52 percent of O&M expenses in 1981-82 and only 38 percent of O&M expenses in 1982-83.

Resource Flows Related to Irrigation Financing: A Comprehensive View

It is important to take a comprehensive view of resource flows related to irrigation financing in India. This requires estimates of capital and current flows into the agricultural sector in terms of investments and O&M expenses incurred on government-managed irrigation systems. It also requires estimates of subsidies on the use of fertilizers, electricity (for water pumping), and diesel oil (for pump-sets and tractors). Resources flow out of the rural sector through payments of land revenue, agricultural income tax, irrigation charges, tax on commercial crops, and indirect taxes on commodities used by households and rural enterprises.

In Table 6.41 an attempt has been made to estimate total resource flows related to irrigation financing in Bihar for the year 1984-85. These estimates have to be taken as preliminary and need further refinement. However, these estimates do provide order-of-magnitude numbers to put in perspective various policy alternatives relating to irrigation financing.[25] Total O&M expenses including revenue establishment were Rs 242.8 million on surface irrigation projects. Total O&M expenses including electricity charges for public tube wells are estimated at Rs 149.6 million. Thus, current expenditure on government-managed irrigation systems is Rs 392.4 million for 1984-85. As against this, collections from irrigated farm sector are: Rs 126.4 million as irrigation charges and Rs 622 million as additional indirect taxes paid by farmers using canal irrigation (Tables 6.23 and 6.41).

Thus, net financial flows from the canal-irrigation sector are Rs 505.6 million. When public tube wells are also considered, net flows are reduced to Rs 356.0 million on account of their high O&M costs but very low irrigation benefits. If gross collections of land revenue are also considered, the area irrigated by canals (1.18 million ha) has contributed about Rs 27 million (an average of Rs 23/ha). Thus, the total estimated current resource flows (revenues) to the Central and State governments on account of canal irrigation were much higher than the current expenditures.

Gross receipts obtained directly from farmers through charging irrigation fees were only 17 percent of the total receipts from this sector. Similarly, net resource flows into irrigation (Rs 116.4 million× Rs 242.8 million - Rs 126.4 million) were about the same as subsidies on the use of imported fertilizers (Rs 103 million) consumed on these farms. This analysis shows that canal irrigated agriculture is providing substantial financial (and real) resources indirectly through commodity taxes etc., and efforts to raise more resources from this sector need not be confined to a mechanical approach which suggests raising irrigation fees to cover O&M expenses plus a percentage of capital costs.

[25]The analysis here is confined to current (annual) revenues and expenditures owing to lack of data on transfers of a capital nature (e.g., plan funds).

Table 6.41. Resource flows related to irrigation financing in Bihar: A comprehensive view (current revenues and expenditures only).

		Annual flows (Current revenues) & expenditures)
A.	*RESOURCE FLOWS INTO AGRICULTURE (1984-85)*	
	Irrigation sector	
1.	*Surface irrigation projects*	(Rs million)
	O&M expenses	167.6
	Direction & administration	4.5
	Revenue establishment	70.7
	Sub-total	242.8
2.	*State tube well projects*	
	O&M expenses (including revenue establishment)	90.3
	Electricity charges	59.3
	Sub-total	149.6
3.	*Private tube wells*	
	Subsidy on electricity charges[a]	868.0
4.	*Fertilizer subsidy[b] on imported ferlizers used on irrigated land*	314.0
5.	Sub-total for the government-managed irrigation (1+2)	392.4
6.	Sub-total for the government-managed irrigated agriculture	476.1
7.	Sub-total for the entire irrigation sector (1+2+3)	1260.4
8.	Total for the irrigated agricultural sector	1574.4
B.	*RESOURCE FLOWS OUT OF AGRICULTURE IN BIHAR 1984-85* (Rs million)	
		Current revenue/expenditure flows
1.	*Land revenue & ag. income tax*	
	Gross collections	84
	Cost of collection	93
	Net revenues	-9
2.	*Irrigation Sector*	
	Direct Receipts	
	Gross collections of irrigation charges	126.4
	Other receipts	n.a.
	Subtotal	126.4
	Indirect Receipts	
	Cess on commercial crops	n.a.
3.	*Indirect Taxes/Revenues*	
	Additional incidence of indirect taxes on households (canal irrigated farms only)	622
	Share of indirect taxes on agro-processing industries	-
	Share of direct taxes on manuafacturing	-
	Export revenues attributable to irrigation	-
	Reduction in import revenue to irrigation	n.a.
4.	Subtotal (2+3)	748.4
C.	*NET FINANCIAL FLOWS (excluding land revenue)*	
1.	Net financial flows for canal irrigation	748.4-248.8 = 505.6
2.	Net financial flows for government-managed irrigation	748.4-392.4 = 356.0
3.	Net financial flows for the total irrigation sector	116.4
4.	Net financial flows for irrigated agriculture	

[a] It is assumed that the entire losses of State Electricity Board are on account of rural electrification, i.e., mainly for state and private tube wells. According to the Report of the Committee on Power of the Government of India (1980), Rural electrification losses in 1976-77 were Rs 1,568 million compared with overall losses of Rs 1,118 million.

[b] Fertilizer consumption (total NPK) in Bihar was estimated at 0.225 million tonnes, i.e., 2.7 percent of the all-India consumption of 8.2 million tonnes. Total fertilizer subsidy was estimated at Rs 18,320 million, i.e., Rs 2,234 per tonne of NPK. Hence the fertilizer subsidy for 0.225 million tonnes was Rs 503 million. If subsidy on only imported fertilzers is considered. It was Rs 1744 per tonne or Rs 392 million it is further assumed that 80 percent of the total fertilzier consumption is on irrigated land. Further, this fertilizer subsidy is distributed between government-managed irrigation system and private tube wells on the basis of area irrigated, i.e., a ratio of 1:2.

Sources: see Tables 8 and 23, 8th Finance Commission Report (1984:182).

SUMMARY AND CONCLUSIONS

The objective of the study was to review the trends in resource mobilization and O&M expenses of government-managed irrigation systems in two States of India — namely, Bihar and Haryana. It was also considered important to take a systems' view of resource flows from canal irrigation by quantifying the indirect resource transfers (e.g., indirect taxation, fixation of "administered" prices for outputs and inputs) arising from government policies. The main conclusions of the study are summarized below:

i) Although irrigation fees for canal irrigation have increased in nominal terms, they have not changed at all over the last decade in real terms, i.e., when changes in prices of rice and wheat are taken into account;

ii) In Bihar, arrears of irrigation charges were between Rs 225-258 million in the last 3 years. These are around three times more than the current charges in these years. Assessed charges for irrigation have declined from Rs 71 million in 1982-83 to Rs 62.4 million in 1984-85, partly due to a decline in area irrigated and partly due to lower average rates. The assessment for industrial water supply has also declined; the assessment for 1984-85 at Rs 10.2 million is 60 percent lower than that in 1982-83.

iii) In Bihar, the Government has an elaborate setup of revenue administration in the Irrigation Department. The costs of this revenue administration are so high that in 1984-85, the *expenditure* on revenue establishment (i.e., cost of collection) at Rs 63.7 million was *higher than the revenues* obtained from providing irrigation services (Rs 48.2 million). Thus, abolition of water charges *and* retrenchment of the staff on revenue administration would have provided the State Government with additional funds of Rs 31.6 million during the 3 years 1982-83 to 1984-85. This suggests that the main purpose of a large revenue administration bureaucracy is to provide employment for people rather than to collect irrigation charges. It is in this context that the possibilities of collecting water rates along with land revenue or through enhanced land revenue for irrigated land should be considered. If this is found difficult, politically, it may be useful to explore the possibilities of recovering irrigation charges through a tax on the use of fertilizers, after a careful consideration of the impact of this tax on the incentive to use fertilizers and resulting impacts on crop yields.

iv) In Haryana, an analysis of data on gross receipts shows that receipts at current prices have increased by 42 percent over the decade 1973-74 to 1982-83. Gross receipts per hectare have increased by about 23 percent, i.e., from Rs 35/ha in 1973-74 to Rs 43/ha in 1983-84. Gross receipts as a percentage of working expenses of irrigation projects have shown wide variations over time; they were about 89 percent in 1973-74, 56 percent in 1980-81, and 38 percent of working expenses in 1982-83.

v) In Bihar, gross receipts from irrigation cover, on average, only 75 percent of O&M expenses; the range being 37 percent for Kosi and 247 percent for Sone. Receipts, net of cost of revenue collection, cover about 33 percent of O&M expenses, on average, the range being negative for Kosi to 85 percent for Sone. Annual collection of irrigation charges has been around 60-80 percent of annual charges and around 20 percent of the total charges (including arrears).

vi) O&M expenses in government-managed surface irrigation projects in Bihar average Rs 81/ha (ranging between Rs 45 and Rs 120, depending on the type of project) and Rs 133/ha in Haryana. Thus, in Bihar, O&M expenses, on average, are 20 percent lower than those considered desirable (and hence recommended) by the Eighth Finance Commission.

vii) An analysis of per hectare O&M expenses in Bihar shows that they have declined in real terms over the last five years. In addition, there has been a significant increase in the "Establishment" component of O&M costs, while the "Works" component has declined. There is a need to analyze whether the decline in "Works" costs indicates only procedural shifts or a decline in the upkeep of the canals and other structures. The cost of revenue establishment for collecting irrigation charges has almost doubled over the last five years. In Haryana, O&M expenses have risen (by 11 percent) in real terms but have fallen in per hectare terms over the 7-year period 1975-76 to 1981-82. In the case of STWs, in Bihar, O&M expenses are not only high but have increased very fast: Rs 1,402/ha in 1980-81 to Rs 4,244/ha of irrigated area in 1984-85.

viii) An analysis of the financial performance of state tube wells in Bihar shows that the total revenues collected by the Bihar Water Development Corporation, in 1984-85, were Rs 0.56 million as compared with O&M expenses of Rs 149 million, showing a net loss of Rs 148.4 million. Thus, revenue collections accounted for a meager 0.4 percent of the O&M expenses in 1984-85.

ix) At the present levels of irrigation charges (or water rates) farmers are paying a small proportion of the net benefit that is due to irrigation. They are also paying a rather small component (less than 3 percent) of the net income (i.e., returns to farm family resources) from irrigated agriculture. The proportion of irrigation-related payments to gross value of output is also very low (less than 2 percent).

x) If irrigation charges are raised to cover O&M expenses of irrigation works, it would result in moderate increases in the proportion of net benefit due to irrigation (or net income) being diverted for irrigation-related payments. However, if water rates are raised to cover full O&M costs and capital investment, it would result in a substantial (50-90 percent) share of net benefits being diverted to irrigation-related payments. It would be necessary to evaluate welfare and disincentive effects of raising irrigation fees to cover O&M expenses as well as full capital cost. It is in this context that prospects of "full cost recovery" need to be considered and analyzed. Since 80 percent of O&M expenses are on salaries and wages, and expenses on the entire revenue administration seem to be for the purpose of creating employment it is unfair to ask the farmers to bear the burden of these (ever-increasing) expenditures. Given the fact that 55 percent of the capital costs of reservoir-type irrigation projects are labor-related payments and there are significant "leakages" in other costs, it is important to consider why the farmers should bear the brunt of it.

xi) Canal irrigation provides substantial increases in incomes which result in higher expenditures and payments of additional indirect taxes to Central and State governments. According to the estimates made in this study, such indirect resource transfers are much higher (around two-and-

one-half times gross O&M expenditures) than direct transfers or payments received in return for irrigation services. Thus, there is a need to explore the possibilities of raising financial resources indirectly through commodity taxes, and efforts to raise more resources from gravity irrigation systems need not be confined to a mechanical (an accountant's) approach which suggests raising irrigation fees to cover O&M expenses plus a percentage of capital costs.

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GLOSSARY OF TERMS

Amin:	The person who takes measurement of the irrigated land surveyed by *patrol.*
Anchal:	Circle; it is generally coterminous with irrigation subdivision under an assistant engineer.
Bajra:	A kind of millet crop (pearl millet).
Irrigation Potential Created:	The irrigation potential created by a project at a given time during or after its construction is the aggregate gross area that can be irrigated annually by the quantity of water that could be made available by all the connected and completed works up to the end of the water courses or the last point for the water delivery system up to which the government is responsible for construction.
Irrigation Potential Utilized:	Irrigation potential utilized is the gross area actually irrigated by a project during the year under consideration.
Kharif:	Crops grown during the monsoon.
Khatiani:	Listing of area irrigated by each farmer indicating each plot surveyed.
Moharrir:	The person who prepares *khatiani* and *parcha,* i.e., collectible charges.
Parcha:	Charges notice.
Patrol:	The person who surveys the land irrigated to prepare panji *sudkar.*
Rabi:	Crops grown during Winter.
Sangrahak:	Peon for collection of land revenue.
Sudkar Area:	Verified area (irrigated).
Sudkar Panji:	Register showing verified area irrigated.
Tehsildar:	Irrigation Revenue Inspector in charge of collection of water charges at circle level.

Ultimate Irrigation:	The ultimate irrigation potential is the gross area that can be irrigated from a project in a designated year for the projected cropping pattern and assumed water allowance on its full development.
Warabandi:	System of rotational water supply.
Wari:	Turn.
Wari-metric:	A system of irrigation charges where water rates are based on the number of turns a farmer receives water for irrigation during a season.
Zilladar:	Circle officer under whom there are two sections: one in charge of assessment and the other in charge of collection.

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